2015 Semiannual Groundwater Monitoring Report

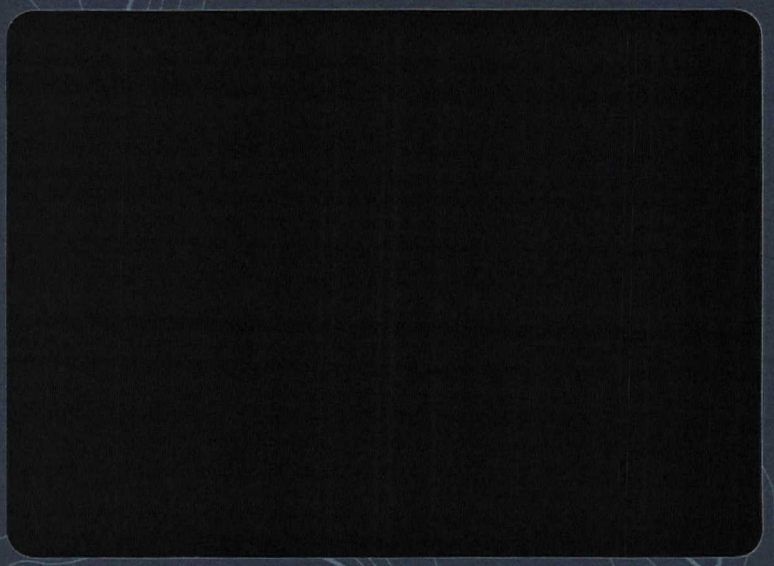
Palermo Wellfield Superfund Site
Tumwater, Washington

for
Washington State Department of Transportation

April 7, 2017

GeoEngineers

1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940



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Prepared for:

Washington State Department of Transportation
PO Box 47331
Olympia, Washington 98504-7331

Attention: Norm Payton

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Lara M. Linde, LG
Geologist

Nick E. Rohrbach
Project Manager

Michael E. Hutchinson, LG, LHG
Principal

LML:NER:MEH:ch

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1.0 INTRODUCTION

This report summarizes the Spring (March) 2015 semiannual groundwater monitoring results for the Palermo Wellfield Superfund Site (Site), United States Environmental Protection Agency (EPA) ID: WA 0000026534, located in Tumwater, Washington (Figure 1).

Washington State Department of Transportation (WSDOT) began groundwater monitoring at the Site in 2013. From 2004 through 2012, EPA conducted long-term, semiannual groundwater monitoring for tetrachloroethene (PCE) and trichloroethene (TCE) as part of the remedy selected for the Site, documented in the Record of Decision (ROD) dated November 16, 1999 (EPA 1999).

In the spring of 1999, EPA began operating an air stripping treatment system at the Palermo Wellfield (Wellfield) to remove TCE from groundwater before being introduced into the City's water supply. Operation and maintenance of the groundwater treatment system is the responsibility of the City of Tumwater (City) based on an agreement with EPA.

TCE and PCE also were detected in surface water samples from the base of the Palermo bluff where surface water ponded in the yards and crawl spaces of nearby homes within the Palermo Neighborhood (Neighborhood). EPA constructed a subdrain system and treatment lagoon in 2000 in the Neighborhood. The subdrain system includes a subgrade perforated piping network installed behind the seven southern-most houses west of SE Rainier Avenue (Figure 2). The main perforated pipe or "trunk drain" is located beneath the backyards of the houses. Groundwater that enters the perforated pipe flows to an unperforated "tightline" pipe beneath SE Rainier Avenue and SE M Street. The tightline pipe drains to the treatment lagoon located at the Municipal Golf Course. The water is treated by surface aeration to remove PCE and TCE from the water before it is discharged to the Deschutes River by way of an existing water course. The purpose of the system is to lower the local groundwater table beneath homes west of SE Rainier Avenue. Following construction and verification of the subdrain and treatment lagoon, a maintenance and monitoring program was established and implemented by the Washington State Department of Ecology (Ecology). Ecology monitored the subdrain and lagoon system performance between 2002 and 2008. From 2009 through 2012, EPA assumed the lead for performance monitoring of the subdrain and treatment lagoon system. WSDOT has been conducting subdrain and lagoon monitoring since 2013.

2.0 SCOPE OF WORK

This semiannual report summarizes data collected during groundwater and subdrain system sampling performed during March 2015. This semiannual report also includes a summary of operations and maintenance activities pertaining to the subdrain and treatment lagoon system. These activities were generally completed using procedures presented in the following documents:

- *Field Sampling and Analysis Plan – Semiannual Groundwater Monitoring, Palermo Wellfield Superfund Site (FSP)* (GeoEngineers 2013a).
- *Operation and Maintenance Manual Subdrain System* and *Treatment Lagoon Palermo Wellfield Superfund Site (O&M Manual)* (URSG 2002).

- *Addendum 1 Operation and Maintenance Manual Subdrain System and Treatment Lagoon, Palermo Wellfield Superfund Site* (GeoEngineers 2013b).
- *Addendum 2 Operation and Maintenance Manual Subdrain System and Treatment Lagoon, Palermo Wellfield Superfund Site (*GeoEngineers 2014a*).*

Activities completed include:

- Collection of groundwater water samples from 44 monitoring locations.
- Collection of water samples from nine subdrain and treatment lagoon locations.
- Measurement of sediment accumulation and discharge rate at 12 subdrain and treatment lagoon locations.

This semiannual report provides a summary of the groundwater data obtained from the Spring 2015 sampling event.

3.0 GROUNDWATER

This section presents information on semiannual groundwater monitoring field activities and analytical results.

3.1. Semiannual Field Activities

Field activities conducted during the semiannual monitoring events included collection of the following number of samples:

Location Type	Spring 2015
Monitoring Wells	29
Shallow Groundwater Piezometers	12
Seeps	0
Wellfield Locations	3

Groundwater and subdrain system water samples were submitted to Onsite Environmental Inc. in Redmond, Washington, for analysis of the following volatile organic compounds (VOCs) using EPA SW-846 Method 8260C:

- Trichloroethene (TCE),
- Tetrachloroethene (PCE),
- Cis-1,2-dichloroethene (cis-1,2-DCE),
- Trans-1,2-dichloroethene (trans-1,2-DCE),
- Vinyl chloride (VC),
- 1,1-Dichloroethene (1,1-DCE),

Attributes of monitoring locations and groundwater level elevations observed during the Spring 2015 sampling event are presented in Tables 1 and 2 and Figures 3 and 4. Field forms associated with the sampling are provided in Appendix A. Specific details about the monitoring locations are described below. Deviations from the FSP are outlined in the Section 3.1.5.

3.1.1. *Monitoring Wells*

Groundwater from 29 monitoring wells was sampled as identified in the FSP (GeoEngineers 2013a). Samples were generally collected using a portable Grundfos submersible pump at monitoring wells with the exception of monitoring wells MW-93-02 and MW-96-17 which were sampled using a peristaltic pump and an internal hand pump, respectively. Field parameter measurements were recorded using a multi-parameter water quality meter and a turbidimeter.

3.1.2. *Shallow Groundwater Piezometers*

Groundwater from 12 piezometers was sampled in accordance with the FSP. Piezometer groundwater samples were collected using a peristaltic pump after field parameter stabilization.

3.1.3. *Seeps*

No seep samples were collected during the Spring 2015 sampling event.

3.1.4. *Wellfield Locations*

Two production wells were sampled at the Wellfield during 2014. Consistent with the FSP, no field parameters were collected from these two locations. Production well TW-16 was also sampled. It is not presently connected to the treatment system so a Grundfos submersible pump was used to collect the sample from this location.

3.1.5. *Deviations from the Groundwater Monitoring FSP*

The list outlined below is specific to deviations from the FSP which occurred during the Spring 2015 sampling event.

- For both monitoring events, MW-96-17 and MW-93-02 were not sampled with a submersible pump. Monitoring well MW-96-17 was sampled using a permanent internal down-hole pump maintained by the City. A peristaltic pump was used to collect the sample from MW-93-02 because an obstruction (stick) was present in the well casing. The stick was partially removed from the casing by the City during the Fall 2013 monitoring event, but could not be completely extracted.
- The City wells MW-96-15 and MW-96-16 contain a different brand of submersible pump (QED Micropurge pump) which is not compatible with the Grundfos submersible pump system. These pumps were removed before sample collection and then replaced after sampling was completed.
- The Wellfield treatment system was offline during the sampling period so samples were not collected from the air stripper tower effluent (ST-1 and ST-2)
- Samples from the two production wells (TW-4 and TW-8) were collected from the overboard location at the rear of each well house because the Wellfield was not operating.
- Production well TW-5 was not sampled because it was decommissioned in January 2014. Monitoring at this location has been discontinued.

- A groundwater sample was collected from production well TW-16 at the request of EPA.
- A piping upgrade was performed by the City in 2014 in which the sample port for production well TW-4 was removed. A new sample port was installed in March 2015 but because the wellfield was not operating, the sample was collected at the overboard location.
- Monitoring well MW-ES-08 was not sampled because it is located within Lake Park Drive SW as a result of recent land development nearby. Collecting samples at MW-ES-08 would require a partial lane closure and traffic control. Groundwater monitoring at this location has been temporarily discontinued (Zavala 2014).
- Monitoring at four seeps (SEEP-1 through SEEP-3, and SEEP-5) and three piezometers at the base of the bluff (PZ-704, PZ-709, and PZ-715) was discontinued in 2014 (Zavala, 2014). However, groundwater depth-to-water measurements were collected from piezometers PZ-704, PZ-709, and PZ-715.
- The Barnes Lake water level was measured at the City's staff gauge (Table 2). The gauge is located northeast of the current WSDOT Materials Testing Laboratory and is maintained by the City.

3.2. Groundwater Monitoring Analytical Results

This section describes the results of the laboratory analysis completed for the Spring 2015 sampling event including a data quality assessment, comparison to ROD cleanup goals, and a brief description of the results from each of the three sample location types. Tabulated analytical data are included in Appendix B. Data validation reports are presented in Appendix C. Laboratory analytical reports are presented in Appendix D. Table 3 and Figures 5 and 6 summarize PCE and TCE concentrations at the groundwater monitoring locations.

3.2.1. Data Quality Assessment

Data quality for the Spring 2015 semiannual groundwater sampling was found to be acceptable. A detailed assessment is provided in the data validation reports in Appendix C.

3.2.2. Groundwater Record of Decision Cleanup Goals

Site groundwater chemicals of concern identified in the 1999 ROD are PCE and TCE (EPA 1999). Analytical results discussed below were evaluated against the ROD remediation goals (RGs) for these chemicals. ROD RGs for PCE and TCE are both 5 micrograms per liter (µg/L), the maximum contaminant level (MCL) for drinking water as referenced in the Federal Clean Water Act.

3.2.3. Monitoring Wells

PCE was detected at concentrations exceeding the 5 µg/L RG in groundwater samples from two of the 29 monitoring wells (MW-ES-04 at 33 µg/L and MW-ES-06 at 13 µg/L) sampled during this event (Figure 5).

TCE was detected at concentrations exceeding the 5 µg/L RG in groundwater samples from 8 of the 29 monitoring wells sampled during this event. The maximum concentration of 99 µg/L TCE detected in a groundwater sample was collected from MW-ES-09, located in the Palermo Neighborhood on SE Rainier Avenue (Figure 6). No additional compounds analyzed were detected in groundwater samples from monitoring wells during this spring monitoring event.

3.2.4. *Shallow Groundwater Piezometers*

Similar to monitoring wells, the shallow groundwater piezometer results were relatively consistent with historical results. PCE and TCE analytical results for the piezometers are presented in Figures 5 and 6.

PCE was not detected at concentrations greater than the 5 µg/L RG in piezometer samples collected during this monitoring event. PCE was detected in groundwater samples from two piezometers (PZ-720 at 0.36 µg/L and RPZ-731 at 0.52 µg/L) at concentrations substantially below the RG of 5.0 µg/L.

TCE was detected at concentrations exceeding the 5 µg/L in groundwater samples from three of the 12 piezometers sampled (PZ-720 at 12 µg/L, PZ-721 at 42 µg/L, and PZ-724 at 34 µg/L). Spring 2015 detected TCE groundwater concentrations ranged from 0.75 µg/L to 42 µg/L.

Cis-1,2-DCE was detected in groundwater samples from three piezometers (PZ-721, PZ-724 and PZ-728) ranging in concentration from 0.29 µg/L to 1.2 µg/L . No additional compounds were detected from piezometers during the spring sampling.

3.2.5. *Wellfield*

TCE was detected in one of the three water supply wells samples collected during the Spring 2015 sampling event. TCE was detected in the groundwater sample from production well TW-16 at a concentration of 10 µg/L, greater than the RG of 5 µg/L. Production well TW-16 was completed in 2012 but has not been connected to the treatment system. No additional compounds were detected at the Wellfield locations.

The Palermo Wellfield treatment system was offline during the Spring 2015 sampling event so effluent samples were not collected from the stripper towers.

4.0 SUBDRAIN AND TREATMENT LAGOON

The purpose of the subdrain and lagoon system is to lower the groundwater depth beneath the homes west of SE Rainier Avenue to at least 18 inches (1.5 feet) below the bottom of the crawlspaces or 3 feet below ground surface (URSG 2002). This decrease in groundwater depth aims at reducing the risk of vapor intrusion into the homes from shallow groundwater that may contain PCE and TCE. Shallow groundwater collected in the subdrain is conveyed via a tightline pipe and treated via surface aeration at the treatment lagoon before it leaves the lagoon (Figure 2). The following sections describe the field activities, results, and conclusions for the subdrain and treatment lagoon performance monitoring.

4.1. Field Activities

Field activities performed during the Spring 2015 monitoring event were in general accordance with the Operation and Maintenance Manual Subdrain System and Treatment Lagoon Palermo Wellfield Superfund Site (O&M Manual) (URSG 2002) and Addendum 1 (GeoEngineers 2013b). Activities performed involving the subdrain, tightline, and treatment lagoon are discussed in the following sections.

4.1.1. *Subdrain and Tightline*

The subsurface subdrain located behind the seven southern-most houses on the western side of Rainier Avenue SE collects shallow groundwater though an underground perforated pipe system and conveys the water to the treatment lagoon through a solid tightline pipe (Figure 2). This section describes performance

monitoring for this portion of the remedy and includes sampling, water elevation monitoring, discharge rate measurements, and sediment accumulation monitoring.

4.1.1.1. SAMPLING

Subdrain cleanout samples were collected using a polyethylene dipper by lowering the cup portion of the dipper into each of the cleanouts, placing it under the outfalls, or submerging it into the water. Samples were submitted to the same laboratory as the groundwater samples under the same chain of custody procedures, and for the same analyses.

4.1.1.2. WATER ELEVATION MONITORING

Depth to water measurements were collected from the Neighborhood piezometers, the subdrain cleanouts and the tightline catch basins using an electronic water level indicator. The measurements were used to calculate groundwater elevations in the Neighborhood (Table 4 and Figure 6).

4.1.1.3. WATER FLOW RATE MEASUREMENTS

Flow rate was measured using a Global Flow Meter as outlined in the site O&M Manual (URSG 2002). Discharge was calculated from the flow rate and water elevation measurements to equate to gallons per minute (gpm). Figure 7 and Table 5 shows the discharge volumes encountered in the subdrain.

4.1.1.4. SEDIMENT ACCUMULATION MONITORING

Total depth measurements were collected using an incrementally marked measuring rod placed inside of each subdrain cleanout and tightline catch basin to assess the sediment accumulated in the subdrain cleanouts and tightline catch basins. Table 6 summarizes the estimated depth of sediment in these structures in comparison to the original surveyed structure bottom.

4.1.2. Treatment Lagoon

Treatment lagoon performance is measured semiannually with respect to sampling and flow rate and once a year for sediment accumulation. Semiannual monitoring occurs at multiple lagoon inflows, treatment lagoon effluent, and a compliance point at the Deschutes River, whereas sediment accumulation monitoring occurs on an annual basis at the treatment lagoon.

4.1.2.1. INFLOWS TO LAGOON

The treatment lagoon receives water from four monitored sources:

- Station 350 – M Street Storm Drain Outfall
- Station 356 – Upstream Watercourse Inflow from the Wetlands
- Station 360 – Tightline Outfall to Treatment Lagoon
- Station 362 – M Street Terminus Catch Basin Outfall

These locations were monitored using the Global Flow Probe, a rigid, incrementally marked tape measure, and dipper for sample collection. The flow probe was used to measure flow rate by placing the probe at the outfall entrance and recording the flow rate. The water level in each outfall was measured using the tape measure. Table 5 summarizes the calculated discharge volume from each of the locations. A sample for chemical analysis was also collected from each of the stations (if flowing) by placing the dipper into the discharge.

4.1.2.2. TREATMENT LAGOON EFFLUENT

Treatment lagoon samples were collected using a polyethylene dipper by lowering and submerging the cup portion into the spillway water. Samples were submitted to the same laboratory as the groundwater samples under the same chain of custody procedures, and for the same analyses.

The treatment lagoon effluent (Station 361) is monitored while aeration is actively occurring. Because the lagoon spillway is armored with rip rap, discharge is measured at an outfall approximately 800 feet downstream at a pond located north of the Tumwater Athletic Club where a more accurate flow rate can be obtained (Table 5) (Figure 2).

4.1.2.3. POINT OF COMPLIANCE

The point of compliance (Station 364) is located at the Deschutes River Outfall located approximately 2,000 feet downstream from the treatment lagoon. This location was monitored and sampled using the same equipment and measuring tools described in the preceding sections. Discharge rate for this station also appears in Table 5.

4.1.2.4. SEDIMENT ACCUMULATION MONITORING

Sediment accumulation monitoring was not performed during the Spring 2015 event. Annual sediment accumulation monitoring for the treatment lagoon typically occurs during the fall monitoring event and will be reported in the 2015 Annual Groundwater Report.

4.1.3. Deviations from the Subdrain and Treatment Lagoon O&M Amendment and QAPP

The following have been noted as deviations with respect to the Subdrain and Treatment Lagoon O&M Amendment and QAPP:

- Flow rate at Station 356 was not obtained during the Spring 2015 monitoring period because this area upstream of the lagoon has become wide and slow and could not be accessed safely.
- Flow rates and samples were not collected at Station 362, M Street Terminus catch basin outfall, for Spring 2015 because no water was present at this location. This is a common occurrence for this outfall.

4.2. Subdrain and Treatment Lagoon Monitoring Analytical Results

This section describes the results of the laboratory analyses completed for the Spring 2015 sampling event. The data validation reports are presented in Appendix C. Laboratory analytical reports are presented in Appendix D. Tables 5 and Figures 4, 5, and 7 summarize PCE and TCE concentrations in groundwater samples collected from piezometers surrounding the subdrain, the subdrain, and treatment lagoon locations.

4.2.1. Data Quality Assessment

Data quality for the Spring 2015 semiannual O&M monitoring was found to be acceptable. A detailed assessment is provided in the data validation reports in Appendix C.

4.2.2. Subdrain

Concentrations of PCE and TCE were detected in the subdrain samples collected during the Spring 2015 monitoring event. PCE was detected in the three cleanout samples and ranged from 4.2 to 11 µg/L. TCE

was also detected in water samples from the three cleanouts and ranged in concentration from 7.0 µg/L to 14 µg/L.

4.2.3. Treatment Lagoon

Monitoring locations for the treatment lagoon are discussed by location including inflows, effluent, and point of compliance.

4.2.3.1. INFLOWS

Inflow results for the treatment lagoon are briefly summarized by location below and in Table 5.

- **Station 350 – M Street Storm Drain Outfall:** TCE was detected in this sample at 1.2 µg/L. PCE was not detected at a concentration greater than the detection limit.
- **Station 356 – Upstream Watercourse:** TCE was detected in a sample from upstream of the treatment lagoon at a concentration of 0.23 µg/L. PCE was not detected at a concentration greater than the detection limit.
- **Station 360 – Subdrain Tightline Outfall:** PCE and TCE were detected during both monitoring events. PCE was detected at a concentration of 3.5 µg/L and TCE was detected at a concentration of 8.6 µg/L.
- **Station 362 – M Street Terminus Catch Basin Outfall:** Samples were not collected because there was no flow during the Spring 2015 monitoring event.

4.2.3.2. LAGOON EFFLUENT

PCE and TCE concentrations in lagoon effluent samples collected post-aeration were 0.24 µg/L and 0.76 µg/L, respectively.

4.2.3.3. POINT OF COMPLIANCE

At the point of compliance located at the Deschutes River, neither PCE nor TCE was detected at a concentration greater than the reporting limit during the Spring 2015 monitoring.

4.2.3.4. RECORD OF DECISION SURFACE WATER DISCHARGE CLEANUP GOALS

The objective is to prevent discharge of groundwater containing PCE and TCE in excess of the surface water RG to the Deschutes River. Remediation goals at the point of compliance (Deschutes River) are 0.8 µg/L for PCE and 2.7 µg/L for TCE.

5.0 REFERENCES

GeoEngineers 2013a. Field Sampling Plan Semiannual Groundwater Monitoring, Palermo Wellfield Superfund Site, Tumwater, Washington. Prepared for Washington State Department of Transportation. February 15, 2013.

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Zavala 2014. Electronic confirmation regarding no sampling at MW-ES-08, PZ-704, PZ-709, PZ-715, Seeps 1 through 3 and 5. July 15, 2014.

TABLES

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Table 1

Well Construction Summary

2015 Semiannual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Well or Piezometer	Well Location		Measuring Point (TOC) Elevation	Screen Interval Depth (feet bgs)		Geologic Unit of Screen Interval	Approximate Screen Interval Elevation		Notes
	Northing	Easting		Top	Bottom		Top	Bottom	
Bluff Area									
MW-UI	616967.53	1038149.35	178.82	17.7	27.7	unknown	161.1	151.1	1,2,5
WDOT-MW-1	617640.6	1038502.3	166.94	30.0	39.5	SP--dense to medium dense, olive green, fine sand	136.9	127.4	3,4,5
WDOT-MW-2	617572.9	1038517.9	165.45	30.0	39.5	SP--very dense, olive green to orange, fine to medium sand	135.5	126.0	3,4,5
MW-100	616814.53	1037366.22	177.70	20.0	30.0	SP-medium dense, brown, fine to coarse sand	157.7	147.7	1,2,5
MW-101A	617215.6	1038148.2	176.47	65.0	75.0	SP-loose, gray, fine to medium sand	111.5	101.5	3,4,5
MW-101B	617198.3	1038151.0	176.41	25.0	35.0	SP-loose to medium dense, light brown, fine to medium sand	151.4	141.4	3,4,5
MW-102	617461.6	1038109.5	166.96	16.0	26.0	SP-loose to medium dense, gray, fine to medium sand	151.0	141.0	3,4,5
MW-103	617769.2	1038225.6	163.40	11.0	21.0	SP-loose to medium dense, gray, fine to medium sand	152.4	142.4	3,4,5
MW-104A	617862.7	1039673.3	170.63	119.0	129.0	SP-medium dense to dense, brown, fine sand	51.6	41.6	3,4,5
MW-104B	617868.8	1039667.6	170.52	52.0	62.0	SP-medium dense, brown, fine grained sand	118.5	108.5	3,4,5
MW-109	617312.79	1038552.35	168.89	64.5	74.5	SP-medium dense to dense, brown, fine to coarse sand	104.4	94.4	1,2,5
MW-111	617663.43	1038824.43	165.41	30.0	40.0	SP-medium dense, brown, fine to medium sand	135.4	125.4	1,2,5
MW-ES-02	617664.68	1039666.61	174.65	95.0	105.0	SM-silty sand	79.7	69.7	1,2,5
MW-ES-03	617546.79	1039463.97	175.07	113.0	123.0	SP to SP-SM-sand with silt	62.1	52.1	1,2,5
MW-ES-04	617548.74	1039477.60	175.11	50.0	60.0	SM/ML/SM-silty sand, sandy silt, silty sand	125.1	115.1	1,2,5
MW-ES-05	617517.36	1039178.92	175.05	86.0	96.0	SP-SM-fine sand with silt	89.1	79.1	1,2,5
MW-ES-06	617517.59	1039200.03	173.30	46.0	56.0	SP-SM-sand +/- silt	127.3	117.3	1,2,5
MW-ES-07	617139.20	1037976.58	177.89	25.0	35.0	SP-sand SP-sand with gravel	152.9	142.9	1,2,5
MW-ES-08	617163.60	1037049.22	177.17	25.0	35.0	SP-SM-sand +/- silt	152.2	142.2	1,2,5
MW-ES-11	617571.6	1038487.8	166.25	80.0	90.0	SW, well graded sand	86.3	76.3	3,4,5
MW-96-15	617161.5	1038944.6	168.85	69.0	79.0	medium fine sand	99.9	89.9	3,4,5
MW-96-16	616828.9	1039709.4	179.58	50.5	60.5	fine medium sand	129.1	119.1	3,4,5
MW-96-17	616770.8	1039836.2	179.51	45.5	55.5	fine brown sand	134.0	124.0	3,4,5
Deschutes Valley Area									
MW-4A	617600.7	1040468.7	109.87	100	110	silty sand and gravel	9.9	-0.1	3,4,5
MW-4B	617600.7	1040468.7	109.83	80	90	silty sand	29.8	19.8	3,4,5
MW-ES-09	617769.4	1040014.5	108.29	20	30	SP-poorly graded sand with silty sand interbed	88.3	78.3	3,4,5
MW-ES-10	617780.1	1040014.3	108.21	82	92	unknown (no description)	26.2	16.2	3,4,5
MW-107	617052.39	1041164.92	114.66	25.0	35.0	ML-very hard, moist, gray silt SP-loose to medium dense, brown, medium to coarse sand	89.7	79.7	1,2,5
MW-110	618032.42	1041013.21	101.93	30.0	40.0	SP-loose to medium dense, gray, fine to medium sand	71.9	61.9	1,2,5
MW-93-02	617159.3	1040344.3	112.84	6.0	11.0	fine silty blue sand brown clay	106.8	101.8	3,4,5
PZ-704	618090.0	1039826.6	110.64	5	7.5	fine to coarse sand with cobbles and boulders	105.6	103.1	3,4,5
PZ-709	617880.0	1039819.2	114.67	5	7.5	fine to coarse sand with cobbles and boulders	109.7	107.2	3,4,5
PZ-715	617683.4	1039815.4	117.82	5	7.5	fine to coarse sand with cobbles and boulders	112.8	110.3	3,4,5
PZ-719	618201.2	1040000.0	106.95	7	10	fine to medium sand	100.0	97.0	3,4,5
PZ-720	618026.8	1039993.1	107.55	7	10	fine to medium sand	100.6	97.6	3,4,5
PZ-721	617874.3	1039991.4	108.15	7	10	fine to medium sand	101.2	98.2	3,4,5
PZ-722	617664.8	1039983.7	108.74	7	10	fine to medium sand	101.7	98.7	3,4,5
PZ-723	618244.6	1040200.8	106.22	7	10	fine to medium sand	99.2	96.2	3,4,5
PZ-724	617976.5	1040198.5	106.28	7	10	fine to medium sand	99.3	96.3	3,4,5
PZ-725	617741.8	1040220.5	107.88	7	10	fine to medium sand	100.9	97.9	3,4,5
PZ-726	618186.5	1040452.6	105.23	7	10	fine to medium sand	98.2	95.2	3,4,5
PZ-728	617851.9	1040464.5	105.11	7	10	fine to medium sand	98.1	95.1	3,4,5
RPZ-730	618230.9	1040684.5	103.85	4.13	9.13	log not on file	99.7	94.7	3,4,5
RPZ-731	617984.7	1040739.1	105.18	4.75	9.75	log not on file	100.4	95.4	3,4,5
RPZ-732	617722.2	1040690.6	105.67	4.63	9.63	log not on file	101.0	96.0	3,4,5
Palermo Wellfield									
TW-4	617493.7	1040659.3	108.95	60	90	large gravel and sand	49.0	19.0	3,4,5
TW-8	617398.0	1040445.6	109.93	70	90	medium to coarse sand and gravel	39.9	19.9	3,4,5
TW-16	617596.0	1040717.2	109.43	54	93	sand and gravel	55.4	16.4	3,4,5

Notes:

[1] Existing well locations and TOC elevations were obtained from previous explorations (Parametrix 2012, URS 1999 and personal communications with EPA 2013).

[2] Horizontal Datum: NAD83 WA State Plane North.

[3] Survey performed by Skillings Connolly, Inc. in October, 2014.

[4] Horizontal Datum: Washington Coordinate System NAD83/11, south zone, based on network RTK GPS ties to WSDOT control points.

[5] Vertical Datum: North American Vertical Datum of 1988 (NAVD 88).

bgs = Below ground surface

TOC = Top of casing

Table 2

Groundwater Depths and Elevations

2015 Semiannual Groundwater Monitoring Report

Palermo Wellfield Superfund Site

Tumwater, Washington

Location	Top-of-Casing Elevation (feet NAVD 88)	Spring 2015	
		Depth-to-Water (feet)	Water Level Elevation (feet NAVD 88)
Monitoring Wells			
MW-4A	109.87	4.93	104.94
MW-4B	109.83	5.04	104.79
MW-93-02	112.84	3.97	108.87
MW-96-15	168.85	25.39	143.46
MW-96-16	179.58	47.39	132.19
MW-96-17[1]	179.51	48.86	130.65
MW-100	177.70	16.62	161.08
MW-101A	176.47	19.39	157.08
MW-101B	176.41	19.16	157.25
MW-102	166.96	9.85	157.11
MW-103	163.40	5.90	157.50
MW-104A	170.63	52.17	118.46
MW-104B	170.52	49.73	120.79
MW-107	114.66	7.84	106.82
MW-109	168.89	19.31	149.58
MW-110	101.93	2.54	99.39
MW-111	165.41	25.63	139.78
MW-ES-02	174.65	52.92	121.73
MW-ES-03	175.07	48.02	127.05
MW-ES-04	175.11	48.36	126.75
MW-ES-05	175.05	37.65	137.40
MW-ES-06	173.30	43.58	129.72
MW-ES-07	177.89	19.85	158.04
MW-ES-09	108.29	-0.11	108.40
MW-ES-10	108.21	-1.84	110.05
MW-ES-11	166.25	15.11	151.14
MW-UI	178.82	19.09	159.73
WDOT-MW-1	166.94	18.91	148.03
WDOT-MW-2	165.45	16.46	148.99
Piezometers			
PZ-704	110.64	4.84	105.80
PZ-709	114.67	2.71	111.96
PZ-715	117.82	3.98	113.84
PZ-719	106.95	2.21	104.74
PZ-720	107.55	3.58	103.97
PZ-721	108.15	2.67	105.48
PZ-722	108.74	-1.05	109.79
PZ-723	106.22	2.36	103.86
PZ-724	106.28	1.06	105.22
PZ-725	107.88	2.14	105.74
PZ-726	105.23	2.83	102.40
PZ-728	105.11	2.00	103.11
RPZ-730	103.85	2.38	101.47
RPZ-731	105.18	3.90	101.28
RPZ-732	105.67	4.29	101.38
Production Wells			
TW-4	108.95	6.20	102.75
TW-8	109.93	4.05	105.88
TW-16	109.43	7.50	101.93
Barnes Lake	157.402*	3.66	161.06

Notes:

[1] Water level measured through top of hand pump.

*Elevation of 0.00 Feet on the Barnes Lake staff gauge.

-- = Not applicable

NAVD = North American Vertical Datum of 1988

Groundwater depth-to-water measurements were collected from monitoring wells, piezometers, production wells, and Barnes Lake on March 9, 2015.

Table 3

TCE and PCE Detected in Groundwater and Seep Samples

2015 Semiannual Groundwater Monitoring Report

Palermo Wellfield Superfund Site

Tumwater, Washington

	Analyte	Tetrachloroethene	Trichloroethene
	ROD Remediation Goal	5	5
Location ID	Date	(µg/L)	(µg/L)
MW-100	5/12/2004	0.5 U	0.5 U
MW-100	9/21/2004	1 U	0.5 U
MW-100	4/26/2005	0.5 U	0.5 U
MW-100	10/5/2005	0.5 U	0.5 U
MW-100	3/16/2006	1 U	1 U
MW-100	10/30/2006	1 U	1 U
MW-100	6/6/2007	1 U	1 U
MW-100	11/12/2007	1 U	1 U
MW-100	5/19/2008	0.5 U	0.5 U
MW-100	10/27/2008	1 U	1 U
MW-100	4/27/2009	0.5 U	0.5 U
MW-100	11/9/2009	0.5 U	0.5 U
MW-100	5/19/2010	0.5 U	0.5 U
MW-100	10/19/2010	0.5 U	0.5 U
MW-100	5/23/2011	0.5 U	0.5 U
MW-100	11/8/2011	0.5 U	0.5 U
MW-100	5/29/2012	0.5 U	0.5 U
MW-100	3/5/2013	1 U	1 U
MW-100	9/19/2013	0.5 U	0.5 U
MW-100	4/15/2014	0.20 U	0.20 U
MW-100	8/20/2014	0.20 UJ	0.20 UJ
MW-100	3/10/2015	0.20 U	0.20 U
MW-101A	3/17/2006	1 U	1 U
MW-101A	5/29/2012	0.5 U	0.5 U
MW-101A	3/6/2013	1 U	1 U
MW-101A	9/17/2013	0.5 U	0.5 U
MW-101A	4/15/2014	0.20 U	0.20 U
MW-101A	8/21/2014	0.20 UJ	0.20 UJ
MW-101A	3/11/2015	0.20 U	0.20 U
MW-101B	3/17/2006	**0.1 J**	**14**
MW-101B	10/31/2006	1 U	**6.2**
MW-101B	6/6/2007	1 U	**5.5**
MW-101B	11/13/2007	1 U	**5.7**
MW-101B	5/20/2008	0.5 U	**6.2**
MW-101B	10/28/2008	1 U	**3.9**
MW-101B	4/28/2009	0.5 U	**17**
MW-101B	11/10/2009	0.5 U	**2.2**
MW-101B	5/19/2010	0.5 U	**3.6**
MW-101B	10/21/2010	0.5 U	**3.3**
MW-101B	5/24/2011	0.5 U	**2.2**
MW-101B	11/8/2011	0.5 U	**3.7**
MW-101B	5/29/2012	0.5 U	**2.7**
MW-101B	3/5/2013	1 U	**3.0**
MW-101B	9/17/2013	0.5 U	**3.3**
MW-101B	4/15/2014	0.20 U	**2.9**
MW-101B	8/21/2014	0.20 UJ	**2.7 J**
MW-101B	3/11/2015	0.20 U	**2.7**
MW-102	6/4/2012	0.5 U	0.5 U
MW-102	3/5/2013	1 U	1 U
MW-102	9/17/2013	0.5 U	0.5 U
MW-102	4/17/2014	0.20 U	0.20 U
MW-102	8/22/2014	0.20 UJ	0.20 UJ
MW-102	3/11/2015	0.20 U	0.20 U
MW-103	6/4/2012	0.5 U	0.5 U
MW-103	3/6/2013	1 U	1 U
MW-103	9/18/2013	0.5 U	0.5 U
MW-103	4/16/2014	0.20 U	0.20 U
MW-103	8/22/2014	0.20 UJ	0.20 UJ
MW-103	3/11/2015	0.20 U	0.20 U
MW-104A	3/17/2006	1 U	**6.6**
MW-104A	10/31/2006	1 U	**11**
MW-104A	6/4/2012	0.5 U	**5.3**
MW-104A	3/7/2013	1 U	**8.0**
MW-104A	9/27/2013	0.5 U	**4.6**
MW-104A	4/18/2014	0.20 U	**3.9**
MW-104A	8/28/2014	0.20 U	**4.5**
MW-104A	3/12/2015	0.20 U	**5.0**
MW-104B	5/11/2004	**1.9**	**0.26 J**
MW-104B	9/21/2004	**1.6**	0.5 U
MW-104B	4/26/2005	**0.97**	0.5 U
MW-104B	10/6/2005	**0.09**	0.5 U
MW-104B	3/16/2006	**1.5**	1 U
MW-104B	10/31/2006	**1.7**	1 U
MW-104B	6/7/2007	**1.9**	1 U
MW-104B	11/13/2007	**2.4**	1 U
MW-104B	5/20/2008	**1.3**	0.5 U
MW-104B	10/28/2008	**1.6**	1 U
MW-104B	4/29/2009	5 U	5 U
MW-104B	11/11/2009	**0.87**	0.5 U
MW-104B	5/20/2010	**1.4**	**0.057 J**
MW-104B	10/22/2010	**1.8**	0.5 U
MW-104B	5/26/2011	**0.95**	0.5 U
MW-104B	11/9/2011	**1.6**	0.5 U
MW-104B	6/4/2012	**1.3**	0.5 U
MW-104B	3/11/2013	**1.4**	1 U

	Analyte	Tetrachloroethene	Trichloroethene
	ROD Remediation Goal	5	5
Location ID	Date	(µg/L)	(µg/L)
MW-ES-07	5/19/2010	0.5 U	**4.8**
MW-ES-07	10/21/2010	0.5 U	**5.1**
MW-ES-07	5/24/2011	0.5 U	**4.5**
MW-ES-07	11/8/2011	0.5 U	**9.7**
MW-ES-07	5/29/2012	0.5 U	**4.4**
MW-ES-07	3/5/2013	1 U	**3.9**
MW-ES-07	9/17/2013	0.5 U	**7.0**
MW-ES-07	4/15/2014	0.20 U	**4.3**
MW-ES-07	8/20/2014	0.20 UJ	**4.2 J**
MW-ES-07	3/11/2015	0.20 U	**3.8**
MW-ES-08	5/29/2012	0.5 U	0.5 U
MW-ES-08	3/5/2013	1 U	1 U
MW-ES-08	9/19/2013	0.5 U	0.5 U
MW-ES-09	5/11/2004	0.5 U	**220**
MW-ES-09	9/22/2004	1 U	**200**
MW-ES-09	4/27/2005	0.5 U	**300**
MW-ES-09	10/6/2005	0.5 U	**120**
MW-ES-09	3/22/2006	1 U	**176**
MW-ES-09	11/2/2006	1 U	**170**
MW-ES-09	6/8/2007	1 U	**169**
MW-ES-09	11/14/2007	1 U	**160**
MW-ES-09	5/21/2008	0.5 U	**150**
MW-ES-09	10/29/2008	1 U	**150**
MW-ES-09	4/30/2009	5 U	**140**
MW-ES-09	11/11/2009	0.5 U	**73**
MW-ES-09	5/21/2010	0.5 U	**150**
MW-ES-09	10/22/2010	0.5 U	**130**
MW-ES-09	5/26/2011	0.5 U	**120**
MW-ES-09	11/9/2011	0.5 U	**150**
MW-ES-09	6/5/2012	0.5 U	**150 J**
MW-ES-09	3/11/2013	1 U	**120**
MW-ES-09	9/26/2013	1 U	**120**
MW-ES-09	4/21/2014	1.0 U	**110**
MW-ES-09	8/28/2014	0.40 U	**100**
MW-ES-09	3/16/2015	0.40 U	**99**
MW-ES-10	5/11/2004	0.5 U	**83**
MW-ES-10	9/22/2004	1 U	**83**
MW-ES-10	4/27/2005	0.5 U	**78**
MW-ES-10	10/6/2005	0.5 U	**75**
MW-ES-10	3/22/2006	1 U	**65**
MW-ES-10	11/2/2006	1 U	**68**
MW-ES-10	6/8/2007	1 U	**63**
MW-ES-10	11/14/2007	1 U	**61**
MW-ES-10	5/21/2008	0.5 U	**46**
MW-ES-10	10/29/2008	1 U	**52**
MW-ES-10	4/30/2009	5 U	**34**
MW-ES-10	11/11/2009	0.5 U	**29**
MW-ES-10	5/21/2010	0.5 U	**53**
MW-ES-10	10/22/2010	0.5 U	**52**
MW-ES-10	5/26/2011	0.5 U	**36**
MW-ES-10	11/9/2011	0.5 U	**53**
MW-ES-10	6/5/2012	0.5 U	**67 J**
MW-ES-10	3/11/2013	1 U	**37**
MW-ES-10	9/26/2013	0.5 U	**36**
MW-ES-10	4/22/2014	0.20 U	**35**
MW-ES-10	8/28/2014	0.20 U	**32**
MW-ES-10	3/16/2015	0.20 U	**37**
MW-ES-11	5/31/2012	0.5 U	0.5 U
MW-ES-11	3/6/2013	1 U	1 U
MW-ES-11	9/17/2013	0.5 U	0.5 U
MW-ES-11	4/17/2014	0.20 U	**0.22**
MW-ES-11	8/25/2014	0.20 UJ	**0.30 J**
MW-ES-11	3/17/2015	0.20 U	**0.33**
MW-UI	5/12/2004	0.5 U	**21 J**
MW-UI	9/21/2004	1 U	**17**
MW-UI	4/26/2005	0.5 U	**8.8**
MW-UI	10/5/2005	0.5 U	**3.6**
MW-UI	3/17/2006	1 U	**5.2**
MW-UI	10/31/2006	1 U	**12**
MW-UI	6/6/2007	1 U	**23**
MW-UI	11/12/2007	1 U	**28**
MW-UI	5/19/2008	0.5 U	**16**
MW-UI	10/28/2008	1 U	**8.3**
MW-UI	4/27/2009	0.5 U	**7.9**
MW-UI	11/10/2009	0.5 U	**3.8**
MW-UI	5/19/2010	0.5 U	**7.8**
MW-UI	10/19/2010	0.5 U	**8.1**
MW-UI	5/24/2011	0.5 U	**11**
MW-UI	11/8/2011	0.5 U	**11**
MW-UI	5/29/2012	0.5 U	**9.3**
MW-UI	3/5/2013	1 U	**8.1**
MW-UI	9/19/2013	0.5 U	**6.6**
MW-UI	4/15/2014	0.20 U	**7.9**
MW-UI	8/20/2014	0.20 UJ	**7.3 J**
MW-UI	3/10/2015	0.20 U	**7.1**

Analyte		Tetrachloroethene	Trichloroethene
ROD Remediation Goal		5	5
Location ID	Date	(µg/L)	(µg/L)
MW-104B	9/27/2013	1.5	0.5 U
MW-104B	4/18/2014	0.99	0.20 U
MW-104B	8/28/2014	1.0	0.20 U
MW-104B	3/12/2015	1.1	0.20 U
MW-107	6/7/2012	0.5 U	0.5 U
MW-107	3/6/2013	1 U	1 U
MW-107	9/20/2013	0.5 U	0.5 U
MW-107	4/18/2014	0.20 U	0.20 U
MW-107	8/27/2014	0.20 U	0.20 U
MW-107	3/13/2015	0.20 U	0.20 U
MW-109	5/12/2004	0.5 U	31
MW-109	9/21/2004	1 U	32
MW-109	4/26/2005	0.5 U	15
MW-109	10/5/2005	0.5 U	22
MW-109	3/20/2006	1 U	27
MW-109	11/1/2006	1 U	25
MW-109	6/7/2007	1 U	22
MW-109	11/13/2007	1 U	22
MW-109	5/20/2008	0.5 U	10
MW-109	10/28/2008	1 U	20
MW-109	4/28/2009	0.5 U	17
MW-109	11/10/2009	0.5 U	8.3
MW-109	5/19/2010	0.5 U	16
MW-109	10/21/2010	0.5 U	17
MW-109	5/24/2011	0.5 U	13
MW-109	11/8/2011	0.5 U	19
MW-109	5/30/2012	0.5 U	13
MW-109	3/5/2013	1 U	15
MW-109	9/18/2013	0.5 U	16
MW-109	4/16/2014	0.20 U	15
MW-109	8/21/2014	0.20 UJ	14 J
MW-109	3/10/2015	0.20 U	15
MW-110	5/12/2004	0.5 U	0.5 U
MW-110	9/21/2004	1 U	0.5 U
MW-110	4/26/2005	0.5 U	0.5 U
MW-110	10/5/2005	0.5 U	0.5 U
MW-110	3/15/2006	1 U	1U
MW-110	10/31/2006	1 U	1 U
MW-110	6/6/2007	1 U	1 U
MW-110	11/12/2007	1 U	1 U
MW-110	5/20/2008	0.5 U	0.5 U
MW-110	10/28/2008	1 U	1 U
MW-110	4/28/2009	0.5 U	0.5 U
MW-110	11/10/2009	0.5 U	0.5 U
MW-110	5/19/2010	0.5 U	0.5 U
MW-110	10/20/2010	0.5 U	0.5 U
MW-110	5/24/2011	0.5 U	0.5 U
MW-110	11/8/2011	0.5 U	0.5 U
MW-110	6/7/2012	0.5 U	0.5 U
MW-110	3/6/2013	1 U	1 U
MW-110	9/20/2013	0.5 U	0.5 U
MW-110	4/18/2014	0.20 U	0.20 U
MW-110	8/27/2014	0.20 U	0.20 U
MW-110	3/13/2015	0.20 U	0.20 U
MW-111	5/12/2004	0.5 U	22
MW-111	9/21/2004	1 U	17
MW-111	4/26/2005	0.5 U	0.5 U
MW-111	10/5/2005	0.5 U	12
MW-111	3/17/2006	1 U	20
MW-111	11/1/2006	1 U	16
MW-111	6/6/2007	1 U	18
MW-111	11/13/2007	1 U	16
MW-111	5/20/2008	0.5 U	14
MW-111	10/28/2008	1 U	17
MW-111	4/28/2009	0.5 U	11
MW-111	11/10/2009	0.5 U	5.8
MW-111	5/19/2010	0.5 U	12
MW-111	10/21/2010	0.5 U	11
MW-111	5/24/2011	0.5 U	12
MW-111	11/8/2011	0.5 U	13
MW-111	5/30/2012	0.5 U	12
MW-111	3/7/2013	1 U	9.1
MW-111	9/19/2013	0.5 U	9.2
MW-111	4/16/2014	0.20 U	8.4
MW-111	8/22/2014	0.20 UJ	7.7 J
MW-111	3/11/2015	0.20 U	8.8

Analyte		Tetrachloroethene	Trichloroethene
ROD Remediation Goal		5	5
Location ID	Date	(µg/L)	(µg/L)
PZ-704	6/6/2012	0.5 U	0.5 U
PZ-704	3/13/2013	1 U	1 U
PZ-704	9/23/2013	0.5 U	0.5 U
PZ-704	4/21/2014	0.20 U	0.20 U
PZ-709	6/6/2012	0.5 U	0.5 U
PZ-709	3/13/2013	1 U	1 U
PZ-709	9/23/2013	0.2 UJ	0.2 UJ
PZ-709	4/21/2014	0.20 U	0.20 U
PZ-715	6/6/2012	0.5 U	0.5 U
PZ-715	3/13/2013	1 U	1 U
PZ-715	9/23/2013	0.5 U	0.5 U
PZ-715	4/21/2014	0.20 U	0.20 U
PZ-719	6/6/2012	0.5 U	1.7
PZ-719	3/14/2013	1 U	1.6
PZ-719	9/24/2013	0.5 U	2.1
PZ-719	1/28/2014	0.20 U	2.0
PZ-719	4/18/2014	0.20 U	1.8
PZ-719	8/18/2014	0.20 UJ	1.5 J
PZ-719	3/16/2015	0.20 U	2.1
PZ-720	2/1/2004	1.1	17
PZ-720	6/6/2012	0.5 U	6.6 J
PZ-720	3/14/2013	0.38 J	5.0
PZ-720	9/24/2013	0.55	9.7
PZ-720	1/29/2014	0.51	6.7
PZ-720	4/18/2014	0.40	5.5
PZ-720	8/19/2014	0.94	16
PZ-720	3/16/2015	0.52	12
PZ-721	2/1/2004	0.79	98
PZ-721	3/15/2006	0.40 J	47
PZ-721	11/2/2006	0.69 J	59
PZ-721	6/5/2007	1 U	35
PZ-721	11/14/2007	0.53 J	52
PZ-721	5/21/2008	0.39 J	41
PZ-721	10/27/2008	1 U	19
PZ-721	4/30/2009	5 U	35
PZ-721	11/11/2009	0.5 U	27
PZ-721	5/19/2010	0.20 J	41
PZ-721	10/20/2010	0.5 U	48
PZ-721	5/26/2011	0.5 U	30
PZ-721	11/10/2011	0.5 U	44
PZ-721	6/6/2012	0.5 U	38
PZ-721	3/14/2013	1 U	30
PZ-721	9/24/2013	0.5 U	54
PZ-721	1/29/2014	0.20 U	34
PZ-721	4/22/2014	0.20 U	37
PZ-721	8/19/2014	0.40 U	61
PZ-721	3/16/2015	0.20 U	42
PZ-722	6/6/2012	0.5 U	0.5 U
PZ-722	3/14/2013	1 U	1 U
PZ-722	9/25/2013	0.5 U	0.5 U
PZ-722	1/29/2014	0.20 U	0.20 U
PZ-722	4/22/2014	0.20 U	0.20 U
PZ-722	8/19/2014	0.20 U	0.20 U
PZ-722	3/17/2015	0.20 U	0.20 U
PZ-723	6/6/2012	0.5 U	0.5 U
PZ-723	3/14/2013	1 U	1 U
PZ-723	9/25/2013	0.5 U	0.5 U
PZ-723	1/28/2014	0.20 U	0.20 U
PZ-723	4/23/2014	0.20 U	0.20 U
PZ-723	8/18/2014	0.20 UJ	0.20 UJ
PZ-723	3/17/2015	0.20 U	0.20 U
PZ-724	2/1/2004	0.45 J	39
PZ-724	3/15/2006	0.3 J	28
PZ-724	11/2/2006	1 U	37
PZ-724	6/5/2007	1 U	15
PZ-724	11/14/2007	1 U	32
PZ-724	5/21/2008	0.22 J	87
PZ-724	10/27/2008	1 U	44
PZ-724	4/30/2009	5 U	35
PZ-724	11/11/2009	0.5 U	28
PZ-724	5/19/2010	0.5 U	34
PZ-724	10/20/2010	0.5 U	43
PZ-724	5/26/2011	0.5 U	30
PZ-724	11/10/2011	0.5 U	53
PZ-724	6/7/2012	0.5 U	13
PZ-724	3/14/2013	1 U	32

Analyte		Tetrachloroethene	Trichloroethene
ROD Remediation Goal		5	5
Location ID	Date	(µg/L)	(µg/L)
MW-4A	3/20/2006	1 U	1 U
MW-4A	6/5/2012	0.5 U	0.5 U
MW-4A	3/12/2013	1 U	1 U
MW-4A	9/26/2013	0.5 U	0.5 U
MW-4A	4/22/2014	0.20 U	0.20 U
MW-4A	8/28/2014	0.20 U	0.20 U
MW-4A	3/13/2015	0.20 U	0.20 U
MW-4B	3/20/2006	1 U	1 U
MW-4B	6/5/2012	0.5 U	0.5 U
MW-4B	3/12/2013	1 U	1 U
MW-4B	9/26/2013	0.5 U	0.5 U
MW-4B	4/22/2014	0.20 U	0.20 U
MW-4B	8/28/2014	0.20 U	0.20 U
MW-4B	3/13/2015	0.20 U	0.20 U
MW-93-02	6/5/2012	0.5 U	0.5 U
MW-93-02	3/12/2013	1 U	1 U
MW-93-02	9/20/2013	0.5 U	0.5 U
MW-93-02	4/17/2014	0.20 U	0.20 U
MW-93-02	8/28/2014	0.20 U	0.20 U
MW-93-02	3/13/2015	0.20 U	0.20 U
MW-96-15	5/30/2012	0.5 U	0.5 U
MW-96-15	3/7/2013	1 U	1 U
MW-96-15	9/17/2013	0.5 U	0.5 U
MW-96-15	4/17/2014	0.20 U	0.20 U
MW-96-15	8/26/2014	0.20 U	0.20 U
MW-96-15	3/17/2015	0.20 U	0.20 U
MW-96-16	6/5/2012	0.5 U	0.5 U
MW-96-16	3/6/2013	1 U	1 U
MW-96-16	9/18/2013	0.5 U	0.5 U
MW-96-16	4/16/2014	0.20 U	0.20 U
MW-96-16	8/26/2014	0.20 U	0.20 U
MW-96-16	3/17/2015	0.20 U	0.20 U
MW-96-17	6/5/2012	0.5 U	0.5 U
MW-96-17	3/6/2013	1 U	1 U
MW-96-17	9/18/2013	0.5 U	0.5 U
MW-96-17	4/15/2014	0.20 U	0.20 U
MW-96-17	8/26/2014	0.20 U	0.20 U
MW-96-17	3/13/2015	0.20 U	0.20 U
MW-ES-02	3/22/2006	1 U	56
MW-ES-02	11/1/2006	1 U	68
MW-ES-02	6/7/2007	1 U	66
MW-ES-02	11/14/2007	1 U	66
MW-ES-02	5/20/2008	0.5 U	47
MW-ES-02	10/29/2008	1 U	50
MW-ES-02	4/29/2009	5 U	43
MW-ES-02	11/11/2009	0.5 U	29
MW-ES-02	5/20/2010	0.5 U	53
MW-ES-02	10/22/2010	0.5 U	58
MW-ES-02	5/26/2011	0.5 U	46
MW-ES-02	11/8/2011	0.5 U	51
MW-ES-02	5/31/2012	0.5 U	47
MW-ES-02	3/7/2013	1 U	38
MW-ES-02	9/20/2013	0.5 U	39
MW-ES-02	4/21/2014	0.20 U	39
MW-ES-02	8/27/2014	0.20 U	34
MW-ES-02	3/11/2015	0.20 U	40
MW-ES-03	5/11/2004	0.5 U	37
MW-ES-03	9/22/2004	1 U	42
MW-ES-03	4/27/2005	0.5 U	22
MW-ES-03	10/6/2005	0.13 J	22
MW-ES-03	3/20/2006	1 U	27
MW-ES-03	11/1/2006	1 U	22
MW-ES-03	6/7/2007	1 U	26
MW-ES-03	11/14/2007	1 U	26
MW-ES-03	5/21/2008	0.5 U	24
MW-ES-03	10/29/2008	1 U	25
MW-ES-03	4/29/2009	5 U	16
MW-ES-03	11/12/2009	0.5 U	12
MW-ES-03	5/20/2010	0.5 U	21
MW-ES-03	10/21/2010	0.5 U	25
MW-ES-03	5/25/2011	0.5 U	21
MW-ES-03	11/9/2011	0.5 U	27
MW-ES-03	6/4/2012	0.5 U	21
MW-ES-03	3/7/2013	1 U	17
MW-ES-03	9/19/2013	0.5 U	18
MW-ES-03	4/17/2014	0.20 U	16
MW-ES-03	8/27/2014	0.20 U	14
MW-ES-03	3/12/2015	0.20 U	16
MW-ES-04	5/11/2004	58	0.52
MW-ES-04	9/22/2004	52	0.44 J
MW-ES-04	4/27/2005	51	0.35 J
MW-ES-04	10/6/2005	38	0.24 J
MW-ES-04	3/20/2006	48	0.8 J
MW-ES-04	11/1/2006	43	1.2
MW-ES-04	6/7/2007	35	1.2
MW-ES-04	11/14/2007	38	1.7
MW-ES-04	5/21/2008	49	1.8

Analyte		Tetrachloroethene	Trichloroethene
ROD Remediation Goal		5	5
Location ID	Date	(µg/L)	(µg/L)
PZ-724	9/25/2013	0.5 U	43
PZ-724	1/29/2014	0.20 U	40
PZ-724	4/22/2014	0.20 U	29
PZ-724	8/19/2014	0.20 U	41
PZ-724	3/16/2015	0.20 U	34
PZ-725	2/1/2004	0.5 U	0.35 J
PZ-725	6/8/2012	0.5 U	0.5 U
PZ-725	3/14/2013	1 U	1 U
PZ-725	9/24/2013	0.5 U	0.5 U
PZ-725	1/29/2014	0.20 U	0.20 U
PZ-725	4/22/2014	0.20 U	0.20 U
PZ-725	8/19/2014	0.20 U	0.20 U
PZ-725	3/17/2015	0.20 U	0.20 U
PZ-726	2/1/2004	0.5 U	3.1
PZ-726	6/8/2012	0.5 U	3.4 J
PZ-726	3/12/2013	1 U	2.7
PZ-726	9/25/2013	0.5 U	3.8
PZ-726	1/28/2014	0.20 U	3.2
PZ-726	4/23/2014	0.20 U	3.1
PZ-726	8/18/2014	0.20 UJ	3.6 J
PZ-726	3/17/2015	0.20 U	3.7
PZ-728	2/1/2004	0.5 U	31
PZ-728	3/15/2006	1 U	24
PZ-728	11/2/2006	1 U	16
PZ-728	6/5/2007	1 U	18
PZ-728	11/14/2007	1 U	21
PZ-728	5/21/2008	0.5 U	14
PZ-728	10/27/2008	1 U	51
PZ-728	4/30/2009	5 U	9.1
PZ-728	11/11/2009	0.5 U	8.2
PZ-728	5/19/2010	0.5 U	10
PZ-728	10/20/2010	0.5 U	12
PZ-728	5/26/2011	0.5 U	6.0
PZ-728	11/10/2011	0.5 U	7.7
PZ-728	6/8/2012	0.5 U	4.5 J
PZ-728	3/7/2013	1 U	4.7
PZ-728	9/25/2013	0.5 U	5.1
PZ-728	1/29/2014	0.20 U	4.2
PZ-728	4/23/2014	0.20 U	4.2
PZ-728	8/18/2014	0.20 UJ	4.0 J
PZ-728	3/16/2015	0.20 U	4.9
RPZ-730	6/4/2012	0.5 U	0.5 U
RPZ-730	3/13/2013	1 U	1 U
RPZ-730	9/24/2013	0.5 U	0.5 U
RPZ-730	1/28/2014	0.20 U	0.20 U
RPZ-730	4/23/2014	0.20 U	0.20 U
RPZ-730	8/18/2014	0.20 UJ	0.20 UJ
RPZ-730	3/17/2015	0.20 U	0.20 U
RPZ-731	6/4/2012	0.5 U	0.61
RPZ-731	3/13/2013	1 U	0.60 J
RPZ-731	9/24/2013	0.5 U	1.6
RPZ-731	1/29/2014	0.20 U	0.64
RPZ-731	4/23/2014	0.20 U	0.65
RPZ-731	8/19/2014	0.20 U	1.6
RPZ-731	3/17/2015	0.20 U	0.75
RPZ-732	6/5/2012	0.5 U	0.5 U
RPZ-732	3/12/2013	1 U	1 U
RPZ-732	9/24/2013	0.5 U	0.5 U
RPZ-732	1/29/2014	0.20 U	0.20 U
RPZ-732	4/22/2014	0.23	0.20 U
RPZ-732	8/19/2014	0.29	0.20 U
RPZ-732	3/16/2015	0.36	0.20 U
Seep 1	5/30/2012	0.5 U	0.5 U
Seep 1	3/19/2013	1 U	1 U
Seep 1	10/2/2013	0.5 U	0.5 U
Seep 1	4/21/2014	0.20 U	0.20 U
Seep 2	5/30/2012	0.5 U	0.5 U
Seep 2	3/19/2013	1 U	1 U
Seep 2	10/2/2013	0.5 U	0.5 U
Seep 2	4/21/2014	0.20 U	0.20 U
Seep 3	5/31/2012	0.5 U	0.5 U
Seep 3	3/19/2013	1 U	1 U
Seep 3	10/2/2013	0.5 U	0.5 U
Seep 3	4/21/2014	0.20 U	0.20 U
Seep 5	5/31/2012	0.5 U	0.5 U
Seep 5	5/31/2012	0.5 U	0.5 U
Seep 5	3/19/2013	1 U	1 U
Seep 5	10/2/2013	0.5 U	0.5 U
Seep 5	4/21/2014	0.20 U	0.20 U
ST-1	6/5/2007	1.0 U	1.0 U
ST-1	11/14/2007	1.0 U	1.0 U
ST-1	5/21/2008	0.5 U	0.5 U
ST-1	10/29/2008	1.0 U	1.0 U
ST-1	5/23/2011	0.5 U	0.5 U
ST-1	11/7/2011	0.5 U	0.5 U
ST-1	4/18/2014	0.20 U	0.20 U
ST-1	8/25/2014	0.20 U	0.20 U

Analyte		Tetrachloroethene	Trichloroethene
ROD Remediation Goal		5	5
Location ID	Date	(µg/L)	(µg/L)
MW-ES-04	10/29/2008	**25**	**1.1**
MW-ES-04	4/29/2009	**21**	**0.56 J**
MW-ES-04	11/12/2009	**16**	**0.38 J**
MW-ES-04	5/20/2010	**42**	**0.64 J**
MW-ES-04	10/21/2010	**34**	**0.60**
MW-ES-04	5/25/2011	**23**	**0.52**
MW-ES-04	11/9/2011	**26**	**0.75**
MW-ES-04	6/4/2012	**31**	**0.82**
MW-ES-04	3/8/2013	**44**	**0.56 J**
MW-ES-04	9/19/2013	**32**	0.5 U
MW-ES-04	4/17/2014	**34**	**0.31**
MW-ES-04	8/27/2014	**16**	0.20 U
MW-ES-04	3/12/2015	**33**	**0.26**
MW-ES-05	5/11/2004	0.5 U	**46 J**
MW-ES-05	9/22/2004	1 U	**44**
MW-ES-05	4/26/2005	0.5 U	**52**
MW-ES-05	10/5/2005	0.5 U	**37**
MW-ES-05	3/21/2006	1 U	**46**
MW-ES-05	11/1/2006	1 U	**58**
MW-ES-05	6/7/2007	1 U	**54**
MW-ES-05	11/13/2007	1 U	**53**
MW-ES-05	5/21/2008	**0.21 J**	**58**
MW-ES-05	10/29/2008	1 U	**41**
MW-ES-05	4/29/2009	5 U	**27**
MW-ES-05	11/11/2009	0.5 U	**16**
MW-ES-05	5/20/2010	0.5 U	**33**
MW-ES-05	10/22/2010	0.5 U	**36**
MW-ES-05	5/25/2011	0.5 U	**30**
MW-ES-05	11/9/2011	0.5 U	**35**
MW-ES-05	5/30/2012	0.5 U	**32**
MW-ES-05	3/8/2013	1 U	**27**
MW-ES-05	9/20/2013	0.5 U	**27**
MW-ES-05	4/21/2014	0.20 U	**25**
MW-ES-05	8/27/2014	0.20 U	**24**
MW-ES-05	3/12/2015	0.20 U	**26**
MW-ES-06	5/11/2004	**31**	**11**
MW-ES-06	9/22/2004	**26**	**11**
MW-ES-06	4/26/2005	**15**	**4.6**
MW-ES-06	10/5/2005	**19**	**11**
MW-ES-06	3/21/2006	**25**	**16**
MW-ES-06	11/1/2006	**34**	**12**
MW-ES-06	6/7/2007	**49**	**6.1**
MW-ES-06	11/13/2007	**40**	**6.9**
MW-ES-06	5/21/2008	**16**	**4.7**
MW-ES-06	10/29/2008	**18**	**5.7**
MW-ES-06	4/29/2009	**16**	5 U
MW-ES-06	11/11/2009	**11**	**2.3**
MW-ES-06	5/20/2010	**18**	**3.1**
MW-ES-06	10/22/2010	**14**	**2.7**
MW-ES-06	5/25/2011	**26**	**1.2**
MW-ES-06	11/9/2011	**36**	**1.6**
MW-ES-06	5/30/2012	**34**	**1.2**
MW-ES-06	3/8/2013	**23**	**0.97 J**
MW-ES-06	9/20/2013	**27**	**0.76**
MW-ES-06	4/21/2014	**13**	**1.1**
MW-ES-06	8/28/2014	**15**	**0.71**
MW-ES-06	3/12/2015	**13**	**0.95**
MW-ES-07	3/20/2006	**0.1 J**	**7.8**
MW-ES-07	10/31/2006	1 U	**11**
MW-ES-07	6/6/2007	1 U	**10**
MW-ES-07	11/13/2007	1 U	**11**
MW-ES-07	5/20/2008	0.5 U	**8.6**
MW-ES-07	10/28/2008	1 U	**6.9**
MW-ES-07	4/28/2009	0.5 U	**4.7**
MW-ES-07	11/10/2009	0.5 U	**3.6**

Analyte		Tetrachloroethene	Trichloroethene
ROD Remediation Goal		5	5
Location ID	Date	(µg/L)	(µg/L)
ST-2	6/5/2007	1.0 U	1.0 U
ST-2	11/14/2007	1.0 U	1.0 U
ST-2	5/21/2008	0.5 U	0.5 U
ST-2	4/29/2009	0.5 U	0.5 U
ST-2	11/10/2009	0.5 U	0.5 U
ST-2	5/18/2010	0.5 U	0.5 U
ST-2	10/20/2010	0.5 U	0.5 U
ST-2	6/11/2012	0.5 U	0.5 U
ST-2	3/7/2013	1.0 U	1.0 U
ST-2	9/18/2013	0.5 U	0.5 U
TW-4	3/15/2006	1.0 U	**3.4**
TW-4	11/2/2006	1.0 U	**2.1**
TW-4	6/4/2007	1.0 U	**3.3**
TW-4	11/14/2007	1.0 U	**2.2**
TW-4	5/21/2008	0.5 U	**0.61**
TW-4	10/29/2008	1.0 U	**1.3**
TW-4	4/30/2009	0.5 U	**1.3**
TW-4	11/10/2009	0.5 U	**0.85**
TW-4	5/18/2010	0.5 U	**1.1**
TW-4	10/20/2010	0.5 U	**0.76**
TW-4	5/23/2011	0.5 U	0.5 U
TW-4	11/7/2011	0.5 U	0.5 U
TW-4	6/11/2012	0.5 U	**0.71 J**
TW-4	3/7/2013	1.0 U	**1.7**
TW-4	9/18/2013	0.5 U	**1.3**
TW-4	4/18/2014	0.20 U	**0.43**
TW-4	8/25/2014	0.20 U	**0.89**
TW-4	3/16/2015	0.20 U	0.20 U
TW-5	3/15/2006	1.0 U	**7.4**
TW-5	11/2/2006	1.0 U	**6.5**
TW-5	6/5/2007	1.0 U	**10**
TW-5	11/14/2007	1.0 U	**8.4**
TW-5	5/21/2008	0.5 U	**3.8**
TW-5	10/29/2008	1.0 U	**3.7**
TW-5	4/29/2009	0.5 U	**2.5**
TW-5	11/10/2009	0.5 U	**1.1**
TW-5	5/18/2010	0.5 U	**1.2**
TW-5	10/20/2010	0.5 U	0.5 U
TW-5	5/23/2011	0.5 U	0.5 U
TW-5	11/7/2011	0.5 U	0.5 U
TW-5	6/11/2012	0.5 U	0.5 U
TW-5	3/7/2013	1.0 U	1.0 U
TW-5	9/18/2013	0.5 U	0.5 U
TW-8	6/11/2012	0.5 U	0.5 U
TW-8	3/7/2013	1.0 U	1.0 U
TW-8	9/18/2013	0.5 U	0.5 U
TW-8	4/18/2014	0.20 U	0.20 U
TW-8	8/25/2014	0.20 U	0.20 U
TW-8	3/16/2015	0.20 U	0.20 U
TW-16	4/18/2014	0.20 U	**9.6**
TW-16	8/27/2014	0.20 U	**19**
TW-16	3/16/2015	0.20 U	**10**
WDOT-MW-1	5/31/2012	0.5 U	0.5 U
WDOT-MW-1	3/7/2013	1 U	1 U
WDOT-MW-1	9/18/2013	0.5 U	0.5 U
WDOT-MW-1	4/16/2014	0.20 U	0.20 U
WDOT-MW-1	8/25/2014	0.20 UJ	0.20 UJ
WDOT-MW-1	3/12/2015	0.20 U	0.20 U
WDOT-MW-2	5/31/2012	0.5 U	0.5 U
WDOT-MW-2	3/6/2013	1 U	1 U
WDOT-MW-2	9/18/2013	0.5 U	0.5 U
WDOT-MW-2	4/16/2014	0.20 U	0.20 U
WDOT-MW-2	8/25/2014	0.20 UJ	0.20 UJ
WDOT-MW-2	3/12/2015	0.20 U	0.20 U

Notes:

µg/L = microgram per liter

J = detected above the method detection limit but below the reporting limit

U = not detected at or above the reporting limit

Bold font type indicates the analyte was detected above the reporting limit.

Gray shading indicates the analyte was detected above the ROD Remediation Goal.

Samples were also analyzed for 1,1-DCE, trans-1,2-DCE, cis-1,2-DCE and vinyl chloride.

Table 4

Neighborhood Piezometer Elevations

2015 Semiannual Groundwater Monitoring Report

Palermo Wellfield Superfund Site

Tumwater, Washington

Location	Top-of-Casing Elevation (feet)[1,2]	Ground Surface Elevation (feet)[1,2]	Spring 2015	
			Depth to Water March 9, 2015 (feet BTOC)	Groundwater Elevation (feet)[2]
Bluff and Rainier Avenue Piezometers				
PZ-704	110.64	108.52	4.84	105.80
PZ-709	114.67	111.99	2.71	111.96
PZ-715	117.82	115.56	3.98	113.84
PZ-720	107.55	108.08	3.58	103.97
PZ-721	108.15	108.35	2.67	105.48
PZ-722	108.74	109.02	-1.05	109.79
Other Neighborhood Piezometers				
PZ-719	106.95	107.36	2.21	104.74
PZ-723	106.22	106.72	2.36	103.86
PZ-724	106.28	106.77	1.06	105.22
PZ-725	107.88	108.39	2.14	105.74
PZ-726	105.23	105.63	2.83	102.40
PZ-728	105.11	105.69	2.00	103.11
RPZ-730	103.85	104.36	2.38	101.47
RPZ-731	105.18	105.41	3.90	101.28
RPZ-732	105.67	105.93	4.29	101.38

Notes:

BTOC = Below top of casing

[1]Elevations surveyed by Skillings Connolly, October 2014.

[2]NAVD 88/11 = North American Vertical Datum of 1988/2011.

Table 5

Discharge Volume and Analytical Results - Subdrain and Lagoon

2015 Semiannual Groundwater Monitoring Report

Palermo Wellfield Superfund Site

Tumwater, Washington

Location	Station Description	Volume (GPM) Units	Tetrachloroethene (µg/L)	Trichloroethene (µg/L)
Flow in Sub-Drain System				
357	Cleanout CO-6	48	**11**	**7.0**
358	Cleanout CO-4	154	**8.1**	**14**
359	Cleanout CO-1	206	**4.2**	**10**
360	Tightline Pipe Outfall	237	**3.5**	**8.6**
Treatment Lagoon Inflows (Non-Sub-Drain)				
350	M Street Storm Drain Outfall	70	0.20 U	**1.2**
356	Watercourse Upstream of Lagoon	NC	0.20 U	**0.23**
362	M Street Terminus Catch Basin Outfall (rarely flows)	NF	NS	NS
Treatment Lagoon Effluent				
361	Lagoon Effluent	1,930	**0.24**	**0.76**
Deschutes River Point of Compliance				
364	Deschutes River Outfall	2,069	0.20 U	0.20 U
	Deschutes River Discharge Remediation Goal		**0.8**	**2.7**

Notes:

GPM = gallons per minute

µg/L = microgram per liter

NS = not sampled

NF = no flow; not calculated

NC = not calculated because flow was too slow to measure

U = parameter not detected above the reporting limit

Bold font type indicates analyte was detected

Exceeds remediation goal at point of compliance

Samples were also analyzed for 1,1-DCE, trans-1,2-DCE, cis-1,2-DCE and vinyl chloride. These compounds were not detected.

Table 6

Sediment Accumulation in Catch Basins and Cleanouts in Subdrain System

2015 Semiannual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Location	Depth to Water (feet)	Water Elevation (feet)[1]	Original Total Depth (Feb. 2001) (feet)	Measured Total Depth (feet)	Net Change[2] (feet)	Catch Basin and Subdrain Cleanout Observations
Spring 2015						
CB-1	5.18	100.09	7.78	7.90	-0.12	Gravel flowing in from west pope and being deposited in sump, fast flow, hard (rocky) bottom.
CB-2	6.60	101.32	8.78	8.10	0.68	Debris in sump (sand, rocks, asphalt), fast flow, soft sump bottom.
CB-3	6.22	101.61	8.81	8.85	-0.04	Free of debris, fast flow, soft sump bottom.
CO-1 (359)	6.20	102.08	7.82	7.68	0.14	Free of debris, fast flow, soft sump bottom.
CO-2	5.58	102.37	7.10	7.11	-0.01	Free of debris, fast flow, soft sump bottom.
CO-3	5.48	102.40	6.84	6.73	0.11	Sediment in sump, moderate flow, soft sump bottom.
CO-4 (358)	6.09	102.53	7.84	7.19	0.65	Free of debris, fast flow, soft sump bottom.
CO-5	6.63	102.57	7.84	7.51	0.33	Roots present in sump, fast flow, soft sump bottom.
CO-6 (357)	5.55	104.10	7.70	7.52	0.18	Free of debris, slow flow, soft sump bottom.
CO-7	6.45	104.19	7.89	7.18	0.71	Free of debris, slow flow, soft sump bottom.
CO-8	6.55	104.19	8.10	7.32	0.78	Free of debris, slow flow, soft sump bottom.

Notes:

Exceeds 0.5 foot accumulated sediment (Section 4.2.1 Trunk Drain, O&M Manual, URS 2002)

[1]NAVD 88/11 = North American Vertical Datum of 1988/2011.

[2]Net change = original total depth from February 2001 minus the measured total depth.

Table 7

Subdrain Performance

2015 Semiannual Groundwater Monitoring Report
Palermo Wellfield Superfund Site
Tumwater, Washington

Compliance Station	Ground Surface Elevation [1] (feet)	Measuring Point Top of Casing Elevation [1] (feet)	Difference in Elevation [2] (feet)	Measured Depth to Water Below Top of Casing [3] (feet)	Calculated Depth to Water Below Ground Surface [4] (feet)	Calculated Groundwater Elevation from Ground Surface [5] (feet)	3 Foot Elevation Reduction Met [6]
Spring 2015							
PZ-720	108.08	107.55	0.53	3.58	4.11	103.97	Yes
PZ-721	108.35	108.15	0.20	2.67	2.87	105.48	No
PZ-722	109.02	108.74	0.28	-1.05	-0.77	109.79	No

Notes:

[1]Elevations in NAVD 88. Surveyed by Skillings Connolly, October 2014.

[2]Ground surface elevation minus measuring point top of casing elevation.

[3]Depth to water measured relative to top of casing.

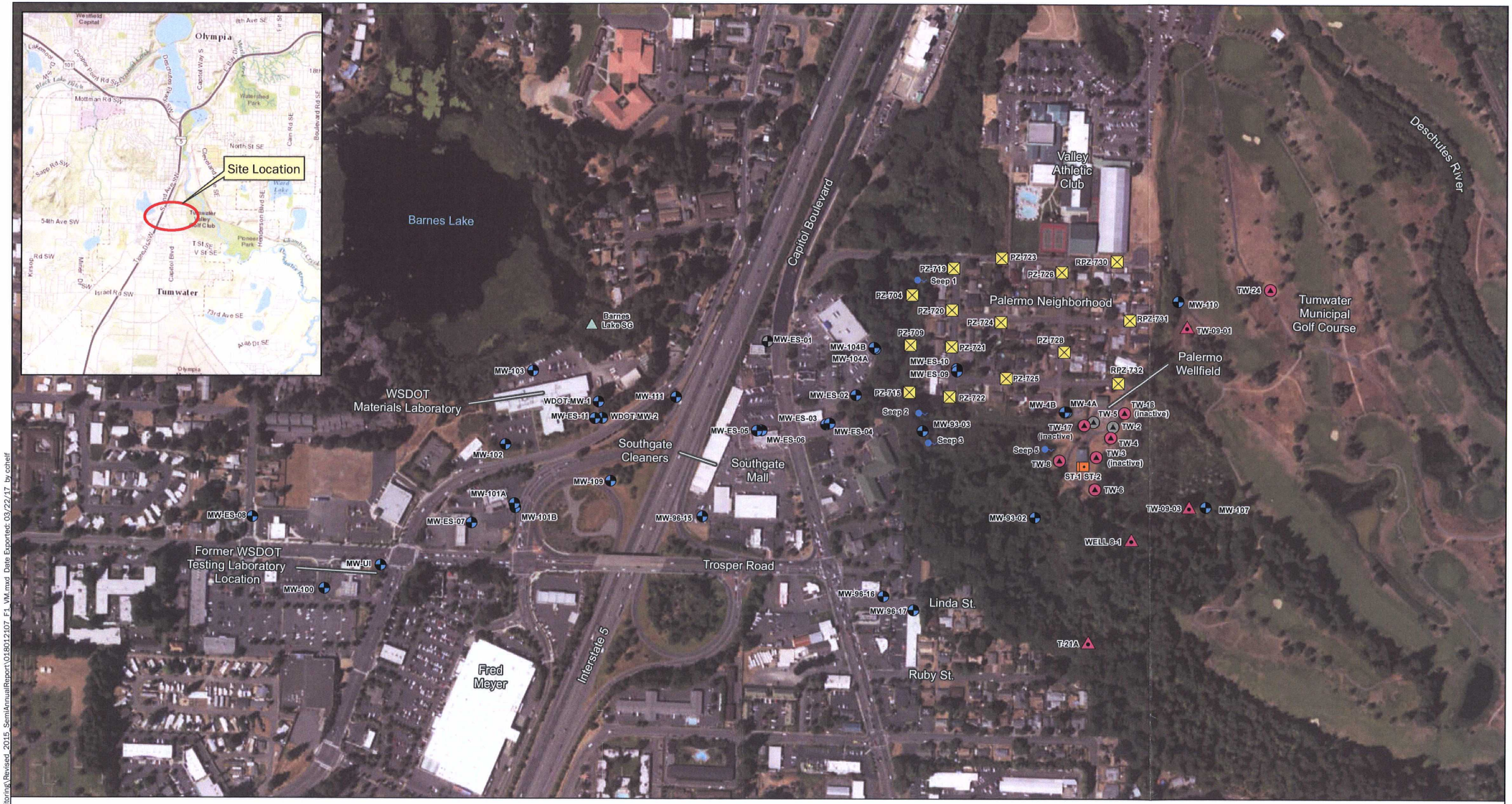
[4]Depth to water calculated relative to ground surface (depth to water measurement plus difference in elevation between ground surface elevation and measuring point top of casing elevation).

[5]Ground surface elevation minus calculated depth to water relative to ground surface.

[6] Performance is evaluated based on achieving a 3 foot water level reduction at piezometers PZ-720, PZ-721, and PZ-722 relative to ground surface elevation (also equivalent to 18 inches below crawlspace floors).

FIGURES

GeoEngineers



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. TW-3. TW-16 and TW-17 are installed but not operating.

Data Source: Long-term monitoring locations provided by Parametrix 2012 and modified using surveyed well and piezometer locations by Skillings Connolly, Inc, Oct. 2014. Imagery from ESRI 2013. Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Barnes Lake staff gauge
- Former city production well and identifier
- Former monitoring well and identifier

N W E S

400 0 400

Feet

Site Plan

Palermo Wellfield Superfund Site

GeoEngineers

Figure 1

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2015_SemiAnnualReport\0180121107_F1_VM.mxd Date Exported: 03/22/17 by cchelf

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2015_SemiAnnualReport\0180121107_F2_NeighborhoodSubdrain.mxd Date Exported: 03/22/17 by cchelf

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. TW-3, TW-16 and TW-17 are installed but not operating.

Data Source: Long-term monitoring locations from Parametrix 2012. Subdrain layout provided by URS 2000 and modified using surveyed cleanout and catch basin point locations by Skillings Connolly, Inc. Oct 2014, Imagery from Thurston County GIS 2012. Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Former city production well and identifier
- Catch basin and identifier
- Subdrain cleanout sampling station and identifier
- Treatment lagoon sampling station and identifier
- Cleanout location and identifier
- Subdrain tightline pipe
- Subdrain perforated pipe

N W E S

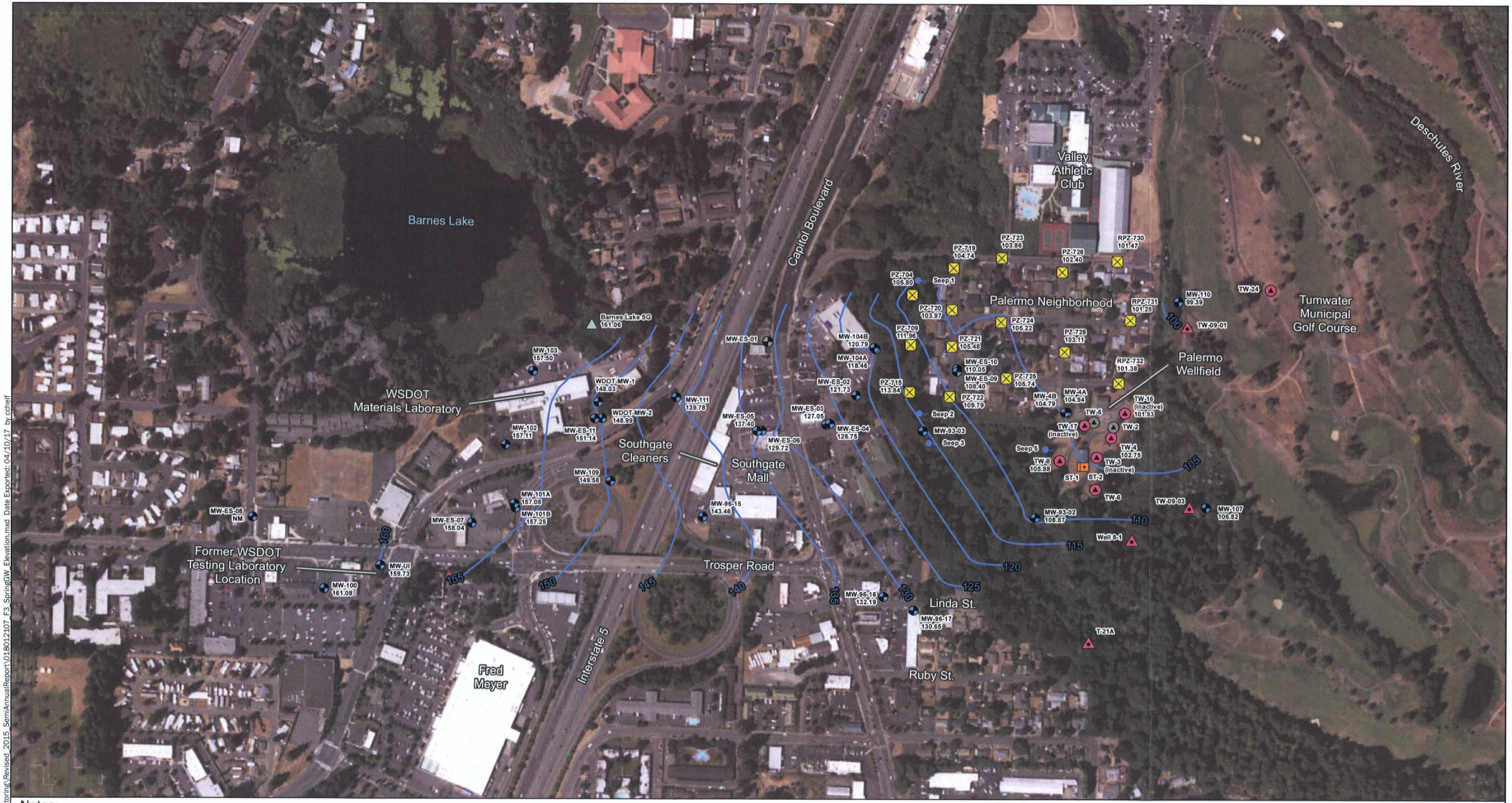
120 0 120
Feet

Palermo Neighborhood and Subdrain

Palermo Wellfield Superfund Site

GeoEngineers

Figure 2



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc.and will serve as the official record of this communication.
3. TW-3, TW-16 and TW-17 are installed but not operating.
4. Groundwater elevations collected March 9, 2015.
5. Groundwater elevation estimated using Surfer (Golden Software) 8.0 contouring software using the Natural Neighbor gridding method.
6. Groundwater elevations are relative to NAVD 88 and shown in feet.

Data Source: Long-term monitoring locations provided by Parametrix 2012 and modified using surveyed well and piezometer locations by Skillings Connolly, Inc, Oct. 2014. Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Barnes Lake staff gauge
- Former city production well and identifier
- Former monitoring well and identifier
- 100 Estimated groundwater elevation
- NM Not Measured

N W E S

400 0 400
Feet

Spring 2015
Generalized Groundwater Elevations

Palermo Wellfield Superfund Site

GeoEngineers

Figure 3

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2015_SemiAnnualReport\0180121 07_SpringGW_Elevation.mxd Date Exported: 04/10/17 by cchelf

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Contours were generated using Surfer 8.0 (Golden Software) contouring software using the natural neighbor gridding method from water level elevations measured on March 9th and 18th, 2015.
4. Groundwater elevations are relative to NAVD 88 and shown in feet.

Data Source: Long-term monitoring locations from Parametrix 2012. Subdrain layout provided by URS 2000 and modified using surveyed cleanout and catch basin point locations by Skillings Connolly, Inc. Oct 2014, Imagery from Thurston County 2012.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Former city production well and identifier
- Catch basin and identifier
- Subdrain cleanout sampling station and identifier
- Treatment lagoon sampling station and identifier
- Cleanout location and identifier
- Subdrain tightline pipe
- Subdrain perforated pipe
- Estimated or inferred groundwater elevation contours

N W E S

120 0 120
Feet

Spring 2015 - Palermo Neighborhood Shallow Groundwater Elevations

Palermo Wellfield Superfund Site

GeoEngineers

Figure 4

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2015_SemiAnnualReport\0180121G7_F4_SpringNeighborhoodGW.mxd Date Exported: 03/22/17 by cheif

P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2015_SemiAnnualReport\0180121107_F5_PCE.mxd Date Exported: 03/22/17 by ochelf

Notes:

1. Concentrations presented in µg/L.
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
4. TW-3, TW-16 and TW-17 are installed but not operating.
5. Groundwater samples collected from March 10 to 17, 2015.

Data Source: Long-term monitoring locations from Parametrix 2012 and modified using Surveyed well and piezometer locations by Skillings Connolly, Inc Oct 2014. Imagery from ESRI 2013.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Former city production well and identifier
- Former monitoring well and identifier
- Barnes Lake staff gauge
- U — Compound not detected at the reporting limit
- NS — Not Sampled

N W E S

400 0 400

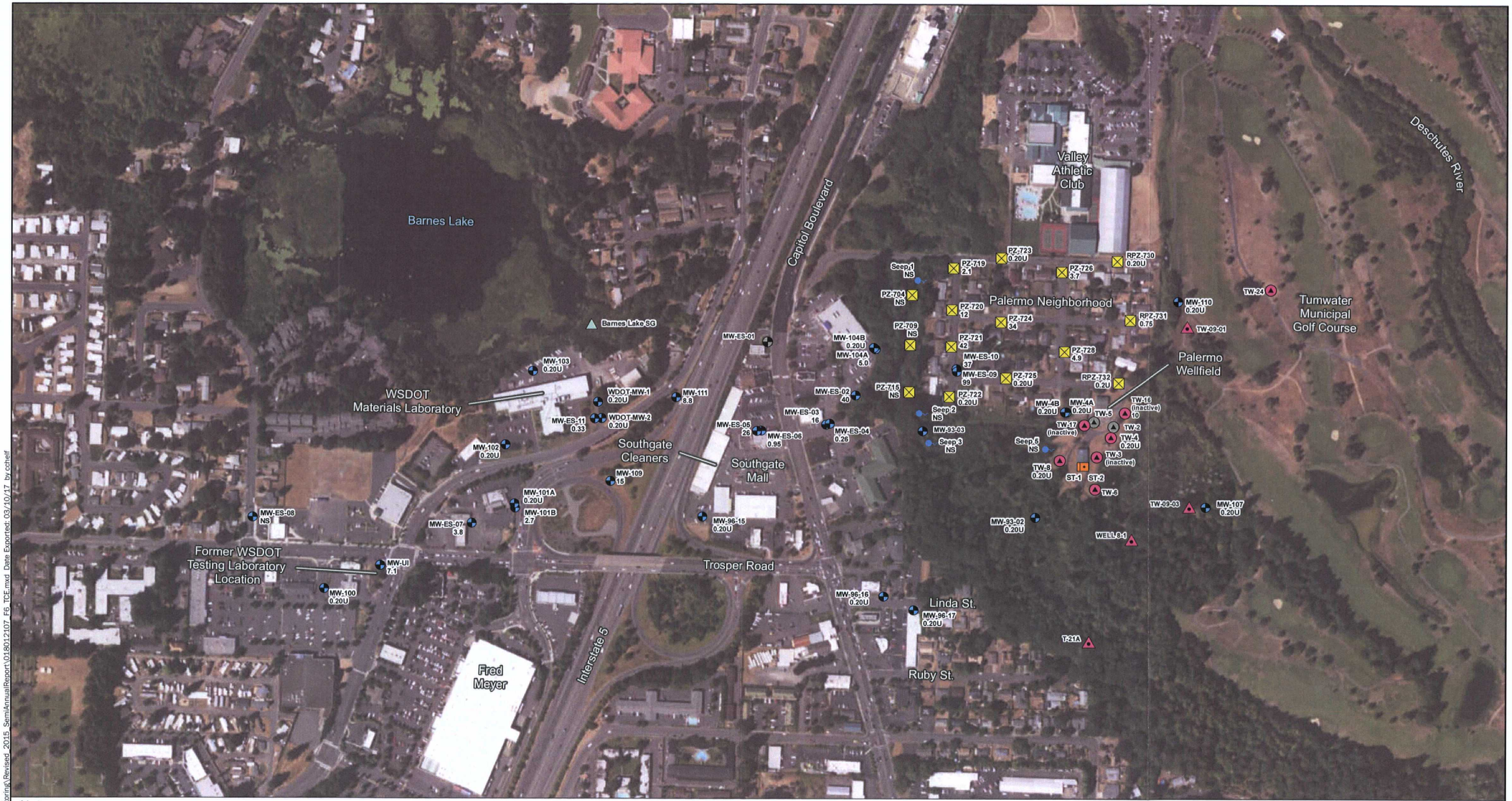
Feet

Spring 2015
PCE Concentrations in Groundwater (µg/L)

Palermo Wellfield Superfund Site

GeoEngineers

Figure 5



P:\0\0180121\GIS\MXDs\GroundWater_Monitoring\Revised_2015_SemiAnnualReport\018012107_F6_TCE.mxd Date Exported: 03/10/17 by cchelf

Notes:

1. Concentrations presented in µg/L
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
4. TW-3, TW-16 and TW-17 are installed but not operating.
5. Groundwater samples were collected form March 10 to 17, 2015.

Data Source: Long-term monitoring locations provided by Parametrix 2012 and modified using surveyed well and piezometer locations by Skillings Connolly Inc, Oct 2014. Imagery from ESRI 2013. Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Former city production well and identifier
- Former monitoring well and identifier
- Barnes Lake staff Gauge
- U — Compound not detected at the reporting limit
- NS — Not Sampled

N W E S

400 0 400

Feet

Spring 2015
TCE Concentrations in Groundwater (µg/L)

Palermo Wellfield Superfund Site

GeoEngineers

Figure 6

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. TW-3, TW-16 and TW-17 are installed but not operating.
4. Subdrain and lagoon samples were collected on March 18, 2015.

Data Source: Long-term monitoring locations from Parametrix 2012. Subdrain layout provided by URS 2000 and modified using surveyed cleanout and catch basin point locations by Skillings Connolly, Inc. Oct 2014, Imagery from Thurston County 2012.
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

- Monitoring well and identifier
- Piezometer and identifier
- Groundwater seep and identifier
- City production well and identifier
- City test well and identifier
- Stripper tower and identifier
- Former city production well and identifier
- Catch basin and identifier
- Subdrain cleanout sampling station and identifier
- Treatment lagoon sampling station and identifier
- Cleanout location and identifier
- U — Compound not detected at the reporting limit
- J — Estimated concentration
- NC — Not calculated
- Subdrain tightline pipe
- Subdrain perforated pipe

N W E S

120 0 120
Feet

Spring 2015 - Subdrain and Treatment Lagoon Monitoring Results Palermo Neighborhood

Palermo Wellfield Superfund Site

GeoEngineers

Figure 7

P:\O\018012\1\GIS MXDs\GroundWater Monitoring\Revised_2015_SemiAnnualReport\018012107_F7_PCE_TCE.mxd Date Exported: 03/22/17 by cchelf

APPENDICES

GeoEngineers

APPENDIX A
Field Forms
(Included on CD)

APPENDIX B
Analytical Data Summary Tables

Table B-1

Groundwater Results

Spring 2015 Semiannual Groundwater Monitoring Report

Palermo Wellfield Superfund Site

Tumwater, Washington

Location	Sample ID	Date	Type	1,1-Dichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Tetrachloroethene (µg/L)	Trans-1,2-Dichloroethene (µg/L)	Trichloroethene (µg/L)	Vinyl Chloride (µg/L)
MW-100	MW-100-150310	3/10/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-101A	MW-101A-150311	3/11/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-101B	MW-101B-150311	3/11/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**2.7**	0.20 U
MW-102	MW-102-150311	3/11/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-103	MW-103-150311	3/11/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-104A	MW-104A-150312	3/12/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**5.0**	0.20 U
MW-104B	DUP02-150312	3/12/2015	Duplicate	0.20 U	0.20 U	**0.98**	0.20 U	0.20 U	0.20 U
MW-104B	MW-104B-150312	3/12/2015	Primary	0.20 U	0.20 U	**1.1**	0.20 U	0.20 U	0.20 U
MW-107	MW-107-150313	3/13/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-109	MW-109-150310	3/10/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**15**	0.20 U
MW-110	MW-110-150313	3/13/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-111	MW-111-150311	3/11/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**8.8**	0.20 U
MW-4A	MW-4A-150313	3/13/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-4B	MW-4B-150313	3/13/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-93-02	MW-93-02-150313	3/13/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-96-15	MW-96-15-150317	3/17/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-96-16	MW-96-16-150317	3/17/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-96-17	MW-96-17-150313	3/13/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
MW-ES-02	MW-ES-02-150311	3/11/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**40**	0.20 U
MW-ES-03	MW-ES-03-150312	3/12/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**16**	0.20 U
MW-ES-04	MW-ES-04-150312	3/12/2015	Primary	0.20 U	0.20 U	**33**	0.20 U	**0.26**	0.20 U
MW-ES-05	MW-ES-05-150312	3/12/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**26**	0.20 U
MW-ES-06	MW-ES-06-150312	3/12/2015	Primary	0.20 U	0.20 U	**13**	0.20 U	**0.95**	0.20 U
MW-ES-07	DUP02-150311	3/11/2015	Duplicate	0.20 U	0.20 U	0.20 U	0.20 U	**3.7**	0.20 U
MW-ES-07	MW-ES-07-150311	3/11/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**3.8**	0.20 U
MW-ES-09	MW-ES-09-150316	3/16/2015	Primary	0.40 U	0.40 U	0.40 U	0.40 U	**99**	0.40 U
MW-ES-10	MW-ES-10-150316	3/16/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**37**	0.20 U
MW-ES-11	MW-ES-11-150317	3/17/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**0.33**	0.20 U
MW-UI	DUP01-150310	3/10/2015	Duplicate	0.20 U	0.20 U	0.20 U	0.20 U	**8.0**	0.20 U
MW-UI	MW-UI-150310	3/10/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**7.1**	0.20 U
PZ-719	PZ-719-150316	3/16/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**2.1**	0.20 U
PZ-720	DUP01-150316	3/16/2015	Duplicate	0.20 U	0.20 U	**0.52**	0.20 U	**12**	0.20 U
PZ-720	PZ-720-150316	3/16/2015	Primary	0.20 U	0.20 U	**0.52**	0.20 U	**12**	0.20 U
PZ-721	PZ-721-150316	3/16/2015	Primary	0.20 U	**0.29**	0.20 U	0.20 U	**42**	0.20 U
PZ-722	PZ-722-150317	3/17/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
PZ-723	PZ-723-150317	3/17/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
PZ-724	PZ-724-150316	3/16/2015	Primary	0.20 U	**1.2**	0.20 U	0.20 U	**34**	0.20 U
PZ-725	PZ-725-150317	3/17/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
PZ-726	PZ-726-150317	3/17/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**3.7**	0.20 U
PZ-728	PZ-728-150316	3/16/2015	Primary	0.20 U	**0.31**	0.20 U	0.20 U	**4.9**	0.20 U
RPZ-730	RPZ-730-150317	3/17/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
RPZ-731	RPZ-731-150317	3/17/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**0.75**	0.20 U
RPZ-732	RPZ-732-150316	3/16/2015	Primary	0.20 U	0.20 U	**0.36**	0.20 U	0.20 U	0.20 U
WDOT-MW-1	WDOT-MW-1-150312	3/12/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WDOT-MW-2	WDOT-MW-2-150312	3/12/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U

Notes:

µg/L = micrograms per liter

U = not detected at or above the reported detection limit

Bold = detected result above the method detection limit.

[Picture]

Table B-2

Subdrain Results

Spring 2015 Semiannual Groundwater Monitoring Report

Palermo Wellfield Superfund Site

Tumwater, Washington

Location	Sample ID	Date	Type	1,1-Dichloroethene (µg/L)	cis-1,2-Dichloroethene (µg/L)	Tetrachloroethene (µg/L)	Trans-1,2-Dichloroethene (µg/L)	Trichloroethene (µg/L)	Vinyl Chloride (µg/L)
Sub-Drain System									
350	350-150318	3/18/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**1.2**	0.20 U
356	356-150318	3/18/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**0.23**	0.20 U
357	357-150318	3/18/2015	Primary	0.20 U	0.20 U	**11**	0.20 U	**7.0**	0.20 U
357	DUP01-150318	3/18/2015	Duplicate	0.20 U	0.20 U	**11**	0.20 U	**6.3**	0.20 U
358	358-150318	3/18/2015	Primary	0.20 U	0.20 U	**8.1**	0.20 U	**14**	0.20 U
359	359-150318	3/18/2015	Primary	0.20 U	0.20 U	**4.2**	0.20 U	**10**	0.20 U
360	360-150318	3/18/2015	Primary	0.20 U	0.20 U	**3.5**	0.20 U	**8.6**	0.20 U
361	361-150318	3/18/2015	Primary	0.20 U	0.20 U	**0.24**	0.20 U	**0.76**	0.20 U
364	364-150318	3/18/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Wellfield Samples									
TW-4	TW-4-150316	3/16/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
TW-8	TW-8-150316	3/16/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
TW-16	TW-16-150316	3/16/2015	Primary	0.20 U	0.20 U	0.20 U	0.20 U	**10**	0.20 U

Notes:

µg/L = micrograms per liter

U = not detected at or above the reported detection limit

Bold = detected result above the method detection limit.

APPENDIX C
Data Validation Reports

GeoEngineers

1101 Fawcett Avenue, Suite 200, Tacoma, Washington 98402, Telephone: 253.383.4940, Fax: 253.383.4923 www.geoengineers.com

Data Validation Report

Project: Palermo Wellfield Remedial Investigation and Feasibility Study
March 2015 Semiannual Groundwater Monitoring and Subdrain System Sampling

GEI File No: 0180-121-09

Date: April 9, 2015

This report documents the results of a United States Environmental Protection Agency (USEPA)-defined Stage 2B data validation (USEPA Document 540-R-08-005; USEPA 2009) of analytical data from the analyses of water samples collected as part of the March 2015 Semiannual Groundwater and Subdrain System sampling events, and the associated laboratory and field quality control (QC) samples. The samples were obtained from the Palermo Wellfield Superfund Site located in Tumwater, Washington.

OBJECTIVE AND QUALITY CONTROL ELEMENTS

GeoEngineers, Inc. (GeoEngineers) completed the data validation consistent with USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2008) (National Functional Guidelines) to determine if the laboratory analytical results meet the project objectives and are usable for their intended purpose. Data usability was assessed by determining if:

- The samples were analyzed using well-defined and acceptable methods that provide reporting limits below applicable regulatory criteria;
- The precision and accuracy of the data are well-defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

In accordance with the Field Sampling Plan, Semiannual Groundwater Monitoring (GeoEngineers 2013a) and Quality Assurance Project Plan Subdrain System and Treatment Lagoon Sampling (GeoEngineers 2013b), the data validation included review of the following QC elements:

- Data Package Completeness
- Chain-of-Custody Documentation
- Holding Times and Sample Preservation
- Surrogate Recoveries
- Method, Trip, and Rinsate Blanks
- Matrix Spikes/Matrix Spike Duplicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates
- Field Duplicates (FDs)
- Internal Standards
- Initial Calibrations (ICALs)
- Continuing Calibrations (CCALs)
- Reporting Limits

VALIDATED SAMPLE DELIVERY GROUPS

This data validation included review of the sample delivery groups (SDGs) listed below in Table 1.

TABLE 1. SUMMARY OF VALIDATED SAMPLE DELIVERY GROUPS

Laboratory SDG	Samples Validated
1503-094	MW-100-150310, MW-109-150310, MW-UI-150310, DUP01-150310, TB-1-150310
1503-108	MW-102-150311, MW-103-150311, MW-111-150311, MW-ES-02-150311, RIN-1-150310, RIN-1-150311, TB-1-150311
1503-109	MW-101A-150311, MW-101B-150311, MW-ES-07-150311, DUP02-150311, RIN-02-150311, TB-2-150311
1503-127	MW-104A-150312, MW-104B-150312, DUP02-150312, MW-ES-04-150312, WDOT-MW-2-150312, RIN02-150312, TB-2-150312
1503-128	MW-ES-03-150312, MW-ES-05-150312, MW-ES-06-150312, WDOT-MW-1-150312, RIN-1-150312, TB-1-150312
1503-146	MW-4A-150313, MW-4B-150313, MW-93-02-150313, RIN02-150313, TB-2-150313
1503-147	MW-107-150313, MW-110-150313, MW-96-17-150313, RIN-1-150313, TB-1-150313
1503-163	MW-ES-09-150316, MW-ES-10-150316, TW-4-150316, TW-8-150316, TW-16-150316, RIN02-150316, TB-2-150316
1503-164	PZ-719-150316, PZ-720-150316, DUP01-150316, PZ-721-150316, PZ-724-150316, PZ-728-150316, RPZ-732-150316, TB-1-150316
1503-182	PZ-722-150317, PZ-723-150317, PZ-725-150317, PZ-726-150317, RPZ-730-150317, RPZ-731-150317, TB-1-150317
1503-183	MW-96-15-150317, MW-96-16-150317, MW-ES-11-150317, RIN02-150317, TB-2-150317
1503-218	350-150318, 356-150318, 357-150318, DUP01-150318, 358-150318, 359-150318, 360-150318, 361-150318, 364-150318, RIN01-150318, TB-1-150318

CHEMICAL ANALYSIS PERFORMED

OnSite Environmental, Inc. (OnSite), located in Redmond, Washington, performed laboratory analysis on the water samples using the following method:

- Volatile Organic Compounds (VOCs) by Method SW8260C

DATA VALIDATION SUMMARY

The results for each of the QC elements are summarized below.

Data Package Completeness

OnSite provided all required deliverables for the data validation according to the National Functional Guidelines. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the relevant laboratory case narrative.

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. The COCs were accurate and complete when submitted to the lab with the exceptions identified below.

SDG 1503-094: The laboratory noted that Sample RIN-1-150310 was written on the COC, but not received in the sample cooler. The sample was located in the field sample refrigerator the next day and sent to the laboratory with the samples collected on 3/11/2015 (SDG 1503-108).

Additionally, the laboratory noted that Samples MW-100-150310, MW-109-150310, and MW-UI-150310 were each received with one broken sample vial.

SDG 1503-164: The laboratory noted that Sample TB-1-150316 was not written on the COC. It was added to the COC by the laboratory.

Holding Times and Sample Preservation

The sample holding time is defined as the time that elapses between sample collection and sample analysis. Maximum holding time criteria exist for each analysis to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times were met for all analyses. The samples within all cooler containers were properly protected with bubble wrap, preserved with wet ice and arrived at the laboratory at the appropriate temperatures of between 2 and 6 degrees Celsius, with exceptions where the temperature was slightly below the lower limit, but above freezing. The out-of-compliance temperatures are detailed below.

SDGs 1503-094, 1503-147, 1503-164, 1503-218: The sample cooler temperature recorded at the laboratory was one degree Celsius. It was determined through professional judgment that since the samples were not frozen, this temperature should not affect the sample analytical results.

Surrogate Recoveries

A surrogate compound is a compound that is chemically similar to the organic analytes of interest, but unlikely to be found in any environmental sample. Surrogates are used for organic analyses and are added to all samples, standards, and blanks to serve as an accuracy and specificity check of each analysis. The surrogates are added to the samples at a known concentration and percent recoveries are calculated following analysis. All surrogate percent recoveries for field samples were within the laboratory control limits.

Method, Trip, and Rinsate Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. A method blank was analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Trip blanks are analyzed to provide an indication as to whether volatile compounds have cross-contaminated other like samples within the transportation process to the laboratory. Twelve (12) trip blanks were collected (one for each cooler): TB-1-150310, TB-1-150311, TB-2-150311, TB-1-150312, TB-2-150312, TB-1-150313, TB-2-150313, TB-1-150316, TB-2-150316, TB-1-150317, TB-2-150317, and TB-1-150318. None of the analytes of interest were detected above the reporting limits in any of the trip blanks.

Equipment rinsate blanks are analyzed to provide an indication as to whether field decontamination and sampling procedures effectively prevent cross-contamination in field activities. Ten (10) equipment rinsate blanks were collected: RIN-1-150310, RIN-1-150311, RIN-02-150311, RIN-1-150312, RIN02-150312, RIN-1-150313, RIN02-150313, RIN02-150316, RIN02-150317, and RIN01-150318. None of the analytes of interest were detected above the reporting limits in any of the rinsate blanks.

Matrix Spikes/Matrix Spike Duplicates

Since the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis on one sample from the associated batch, known as the parent sample. One aliquot of the sample is analyzed in the normal manner and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery is calculated. Matrix spike duplicate (MSD) analyses are generally performed for organic analyses as a precision check and analyzed in the same sequence as a matrix spike. Using the result values from the MS and MSD, the relative percent difference (RPD) is calculated. The percent recovery control limits for MS and MSD analyses are specified in the laboratory documents, as are the RPD control limits for MS/MSD sample sets.

One MS/MSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

Laboratory Control Samples/Laboratory Control Sample Duplicates

A laboratory control sample (LCS) is a blank sample that is spiked with a known amount of analyte and then analyzed. An LCS is similar to an MS, but without the possibility of matrix interference. Given that matrix interference is not an issue, the LCS/LCSD control limits for accuracy and precision are usually more rigorous than for MS/MSD analyses. Additionally, data qualification based on LCS/LCSD analyses would apply to all samples in the associated batch, instead of just the parent sample. The percent recovery control limits for LCS and LCSD analyses are specified in the laboratory documents, as are the RPD control limits for LCS/LCSD sample sets.

One LCS/LCSD analysis should be performed for every analytical batch or every 20 field samples, whichever is more frequent. The frequency requirements were met for all analyses and the percent recovery and RPD values were within the proper control limits.

Field Duplicates

In order to assess precision, field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. Precision is determined by calculating the RPD between each pair of samples. If one or more of the sample analytes has a concentration greater than five times the reporting limit for that sample, then the absolute difference is used instead of the RPD. The RPD control limit for water samples is 20 percent.

SDG 1503-094: One field duplicate sample pair, MW-UI-150310 and DUP01-150310, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG 1503-109: One field duplicate sample pair, MW-ES-07-150311 and DUP02-150311, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG 1503-127: One field duplicate sample pair, MW-104B-150312 and DUP02-150312, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG 1503-164: One field duplicate sample pair, PZ-720-150316 and DUP01-150316, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

SDG 1503-218: One field duplicate sample pair, 357-150318 and DUP01-150318, was submitted with this SDG. The precision criteria for all volatile target analytes were met for this sample pair.

One FD shall be collected and analyzed for every 20 field samples, or one per sampling event (whichever is greater), to verify the precision of laboratory and/or sampling methodology. The frequency requirements were met for all analyses.

Internal Standards (Low Resolution Mass Spectrometry)

Like the surrogate, an internal standard is a compound that is chemically similar to the analytes of interest, but unlikely to be found in any environmental sample. Internal standards are used only for the mass spectrometry instrumentation and are usually added to the sample aliquot after extraction has taken place. The internal standard should be analyzed at the beginning of a 12 hour sample run and the control limits for internal standard recoveries are 50 percent to 200 percent of the calibration standard. All internal standard recoveries were within the control limits.

Initial Calibrations (ICALs)

All initial calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. All percent relative standard deviation (%RSD) values were less than +/- 30 percent and all relative response factors (RRF) were greater than 0.05.

Continuing Calibrations (CCALs)

All continuing calibrations were conducted according to the laboratory methods and consisted of the appropriate number of standards. All percent difference (%D) values were less than +/- 25 percent and all relative response factors (RRF) were greater than 0.05.

Reporting Limits

The contract required quantitation limits (CRQL) were met by the laboratory for all target analytes throughout this sampling event.

OVERALL ASSESSMENT

As was determined by this data validation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the surrogate, LCS/LCSD, and MS/MSD percent recovery values. Precision was acceptable, as demonstrated by the LCS/LCSD, MS/MSD, and field duplicate RPD values.

No analytical results were qualified. All data are acceptable for the intended use.

REFERENCES

U.S. Environmental Protection Agency (USEPA) 2009. "Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use," EPA-540-R-08-005. January 2009.

U.S. Environmental Protection Agency (USEPA) 2008. "Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review," EPA-540-R-08-01. June 2008.

GeoEngineers, Inc. 2013a. "Field Sampling Plan, Semiannual Groundwater Monitoring", prepared for Washington State Department of Transportation. February 15, 2013.

GeoEngineers, Inc. 2013b. "Quality Assurance Project Plan, Subdrain System and Treatment Lagoon Sampling," prepared for Washington State Department of Transportation. February 15, 2013.

APPENDIX D
Laboratory Analytical Data Reports
(Included on CD)

APPENDIX E
Report Limitations and Guidelines for Use

APPENDIX E
REPORT LIMITATIONS AND GUIDELINES FOR USE

This appendix provides information to help you manage your risks with respect to the use of this report.

Report Use and Reliance

This report has been prepared for the Washington State Department of Transportation and can be distributed to Client's authorized agents and regulatory agencies as needed for the project.

GeoEngineers structures our services to meet the specific needs of our clients. Accordingly, no party other than the Washington State Department of Transportation may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client for this project and generally accepted environmental practices in this area at the time this report was prepared.

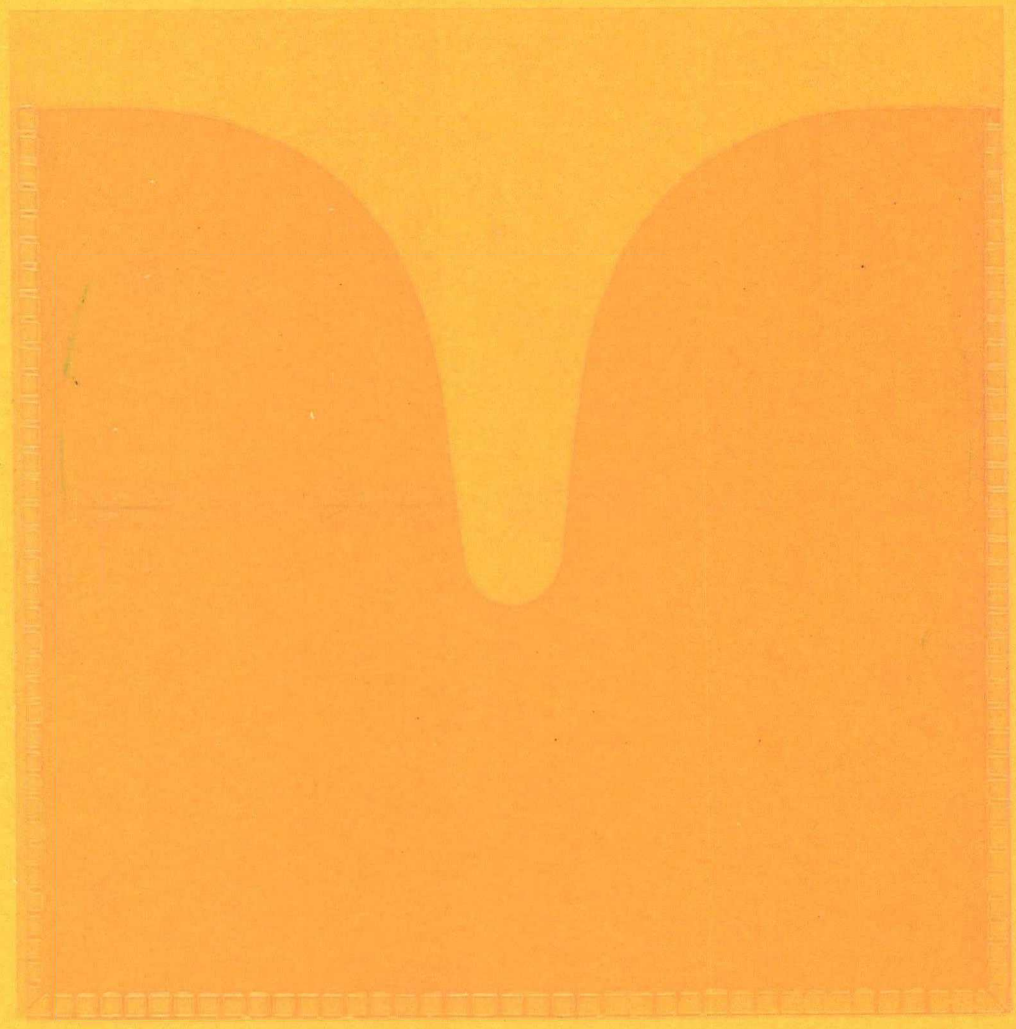
This report should not be applied for any purpose or project except the one originally contemplated. If important changes are made to the project or property after the date of this report, we recommend that GeoEngineers be given the opportunity to review our interpretations and recommendations, and then we can provide written modifications or confirmation, as appropriate.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we used sources that are believed to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

Professional Judgment

It is important to recognize that the environmental sciences practices are less exact than other engineering and natural science disciplines. By necessity, GeoEngineers uses its professional judgment in arriving at our conclusions and recommendations. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce the risk of misunderstandings regarding the inexact nature of our professional services. Please confer with GeoEngineers if you need to know how these "Report Limitations and Guidelines for Use" apply to your project or site.



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